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INTERFACING ENGINEERING APPLICATIONS TO THE
THREE-TIER DATA MODEL ARCHITECTURE

22 ~

ENGINEERING APPLICATIONS



TIER 1 - CLASS VIEWS 20

TIER II - COMPOSITE CLASS VIEWS

TIER III - CONCEPTUAL SCHEMAS

FIG. 1

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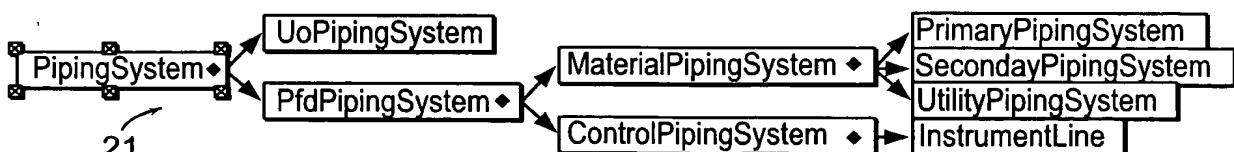
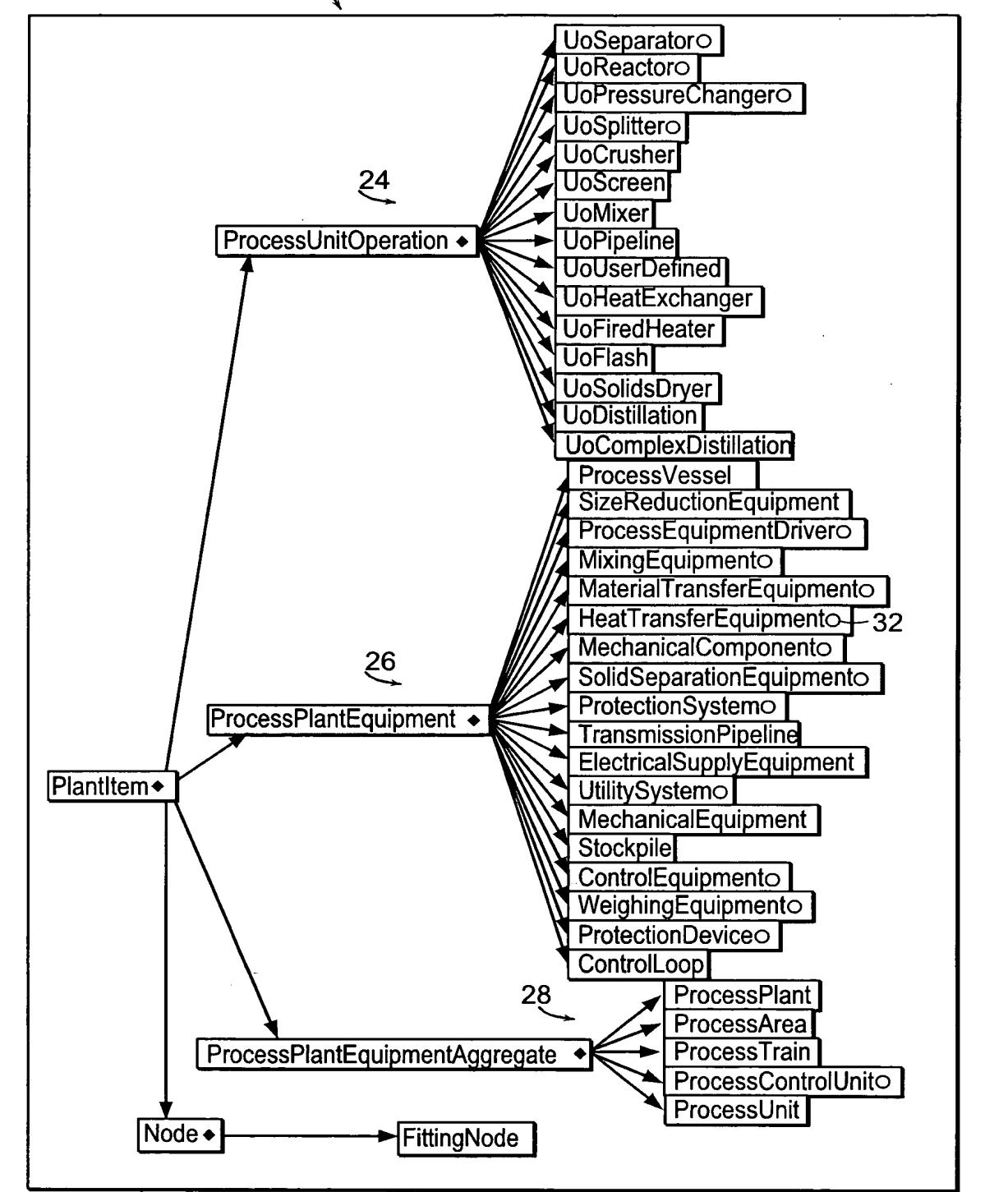


FIG. 2

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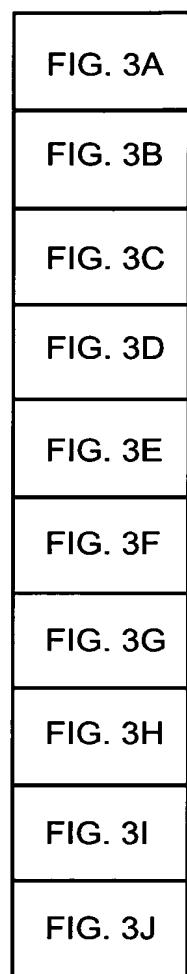


FIG. 3

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Class 'ShellAndTubeHeatExchanger'		Name	<u>42</u>	Type	<u>44</u>	Quantity Type	<u>46</u>	Source	<u>48</u>
	DefaultSymbol			String				ShellAndTubeHeatExchanger	
Type				String				ShellAndTubeHeatExchanger	
TEMAClass				eTemaClass(ShellAndTubeHeatExchanger),				ShellAndTubeHeatExchanger	
TEMAType				String				ShellAndTubeHeatExchanger	
TEMARemarks				String				ShellAndTubeHeatExchanger	
TEMAOrientation				eTemaOrientation_PIPVEDST003				ShellAndTubeHeatExchanger	
AdditionalRemarks				String				ShellAndTubeHeatExchanger	
⊖ Assemblies				ShellAndTubeAssembly				ShellAndTubeHeatExchanger	
⊕ Bundle				ExchangerBundle				ShellAndTubeAssembly	
⊕ Ends				ExchangerEnd				ShellAndTubeAssembly	
⊕ Channel				ExchangerChannel				ShellAndTubeAssembly	
⊕ Gasket				Gasket				ShellAndTubeAssembly	
⊕ Piping				ExchangerPiping				ShellAndTubeAssembly	
⊖ ShellSide				ExchangerShell				ShellAndTubeAssembly	
⊕ Shell				Shell				ExchangerShell	
NumberShellPasses				Integer				ExchangerShell	
BodyFlangeType				eBodyFlangeType(ExchangerShell)				ExchangerShell	
⊕ BodyFlangeMaterial				ConstructionMaterial				ExchangerShell	
⊕ ExternalBoltingMaterial				ConstructionMaterial				ExchangerShell	
⊕ InternalBoltingMaterial				ConstructionMaterial				ExchangerShell	
⊕ NozzleFlangeMaterial				ConstructionMaterial				ExchangerShell	

FIG. 3A

<input checked="" type="checkbox"/> NozzleNeckMaterial	ConstructionMaterial	32 ~	ExchangeShell
<input checked="" type="checkbox"/> NozzleReinforcementMaterial	ConstructionMaterial		ExchangeShell
<input checked="" type="checkbox"/> PipeAndStubEndMaterial	ConstructionMaterial		ExchangeShell
<input checked="" type="checkbox"/> CoverType	eShellCoverType(ExchangerShell)		ExchangeShell
<input checked="" type="checkbox"/> CoverMaterial	ConstructionMaterial		ExchangeShell
<input checked="" type="checkbox"/> TemaShellType	eShellTEMAType		ExchangeShell
InnerDiameter	Real	Length normal	ExchangeShell
OrientationAngle	Real	Plane angle POT	ExchangeShell
OuterDiameter	Real	Length normal	ExchangeShell
RearSupportPlateType	String	Length small	ExchangeShell
Thickness	Real	Length normal	ExchangeShell
VerticalHeight	Real	Area normal	ExchangeShell
EffectiveArea	Real	Area normal	ExchangeShell
TotalArea	Real	Temperature tmp	ExchangeShell
AverageMetalTemperature	Real		ExchangeShell
<input checked="" type="checkbox"/> Velocities	ExchangerFluidVelocity		ExchangeShell
ExpansionJointRequired	Boolean		ExchangeShell
<input checked="" type="checkbox"/> ExpansionJoints	ExpansionJoint		ExchangeShell
<input checked="" type="checkbox"/> FrontEndVapourBelt	VapourBelt		ExchangeShell
<input checked="" type="checkbox"/> RearEndVapourBelt	VapourBelt		ExchangeShell
KettleInnerDiameter	Real	Length normal	ExchangeShell
KettleInnerDiameter	Real	Length normal	ExchangeShell
KettlePortAngle	Real	Plane angle POT	ExchangeShell

FIG. 3B

KettlePortLength	Real	Length normal	ExchangerShell	
Kettle Type	eKettleType(ExchangerShell)		ExchangerShell	
⊕ ChannelMaterial	ConstructionMaterial		ExchangerShell	
⊕ ChannelCoverMaterial	ConstructionMaterial		ExchangerShell	
⊕ FloatingHeadCoverMaterial	ConstructionMaterial		ExchangerShell	
⊕ Lining	ConstructionMaterial		ExchangerShell	
⊕ Gasket	Gasket		ExchangerShell	
InletAtChannelEnd	Boolean		ExchangerShell	
NumberCondensateNozzles	Integer		ExchangerShell	
NumberInletNozzles	Integer		ExchangerShell	
NumberIntermediateNozzles	Integer		ExchangerShell	
NumberLiquidOnlyOutletNozzles	Integer		ExchangerShell	
NumberOutletNozzles	Integer		ExchangerShell	
NumberVapourOnlyOutletNozzles	Integer		ExchangerShell	
InletNozzleLocation	eInletNozzleLocation(ExchangerShell)		ExchangerShell	
MechanicalCleaning	String		ExchangerShell	
EntranceConstruction	eEntranceConstruction(ExchangerShell)		ExchangerShell	
ExitConstruction	eExitConstruction(ExchangerShell)		ExchangerShell	
⊕ MassBalanceIn	UoPort		ExchangerShell	
⊕ MassBalanceOut	UoPort		ExchangerShell	
MaximumHydrogenPartialPressure	Real	Pressure abs	ExchangerSide	
MaximumH2SPartialPressure	Real	Pressure abs	ExchangerSide	
NumberOfPasses	Integer		ExchangerSide	

FIG. 3C

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Remarks	String	MechanicalComponent
NamePrecedent	String	MechanicalComponent
ApplicableTo	eApplicableTo(ProcessPlantEquipment)	ProcessPlantEquipment
DefaultSymbol	String	ProcessPlantEquipment
ConstructionStatus	eConstructionStatus	ProcessPlantEquipment
NamePrecedent	String	ProcessPlantEquipment
④ MaterialPorts	MaterialPort	ProcessPlantEquipment
④ SignalPorts	SignalPort	ProcessPlantEquipment
EquipmentFunction	String	ProcessPlantEquipment
Manufacturer	String	ProcessPlantEquipment
PurchasedCapitalCost	Real	ProcessPlantEquipment
DeliveredCapitalCost	Real	ProcessPlantEquipment
InstalledCapitalCost	Real	ProcessPlantEquipment
NumberOfSpares	Integer	ProcessPlantEquipment
NumberInService	Integer	ProcessPlantEquipment
NumberRequired	Integer	ProcessPlantEquipment
PidNumber	String	ProcessPlantEquipment
Size	String	ProcessPlantEquipment
Function	String	ProcessPlantEquipment
OperatingFactor	String	ProcessPlantEquipment
Model	String	ProcessPlantEquipment
SerialNumber	String	ProcessPlantEquipment
ManufacturersSerialNumber	String	ProcessPlantEquipment

FIG. 3D

FIG. 3E

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	FabricatorAddress2	String	ProcessPlantEquipment
	FabricatorPhone	String	ProcessPlantEquipment
	SuppliedBy	ePurchaserOrManufacturer	ProcessPlantEquipment
	MountedBy	ePurchaserOrManufacturer	ProcessPlantEquipment
	ModelNumber	String	ProcessPlantEquipment
	ApplicableStandard	String	ProcessPlantEquipment
	Orientation	String	ProcessPlantEquipment
⊕	Customer	ProcessPlantCorporation	ProcessPlantEquipment
	JobNumber	String	ProcessPlantEquipment
	PoNumber	String	ProcessPlantEquipment
	PoDate	String	ProcessPlantEquipment
	InquiryBy	String	ProcessPlantEquipment
	InquiryNumber	String	ProcessPlantEquipment
	SpecificationNumber	String	ProcessPlantEquipment
	RequisitionNumber	String	ProcessPlantEquipment
	SAPNumber	String	ProcessPlantEquipment
⊕	MaximumUtilities	SiteUtilityService	ProcessPlantEquipment
⊕	MinimumUtilities	SiteUtilityService	ProcessPlantEquipment
⊕	Utilities	SiteUtilityService	ProcessPlantEquipment
⊕	UtilitySummary	UtilitySummary	ProcessPlantEquipment

FIG. 3F

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PaintSpecifications		32~	
⊕ PaintSpecifications	Boolean		ProcessPlantEquipment
Mounting	String		ProcessPlantEquipment
CostingReference	Cost		ProcessPlantEquipment
⊕ CostData	ControlEquipment		ProcessPlantEquipment
⊕ ControlEquipment	Documentation		ProcessPlantEquipment
⊕ Documentation	SupplierData	ProcessPlantCorporation	ProcessPlantEquipment
⊕ SupplierData	CustomerData	ProcessPlantCorporation	ProcessPlantEquipment
⊕ CustomerData	FabricatorData	ProcessPlantCorporation	ProcessPlantEquipment
⊕ FabricatorData	ManufacturerData	ProcessPlantCorporation	ProcessPlantEquipment
⊕ ManufacturerData	Purchaser	ProcessPlantCorporation	ProcessPlantEquipment
⊕ Purchaser	Type	String	PlantItem
Type	ItemNumber	String	PlantItem
ItemNumber	ItemSequenceNumber	String	PlantItem
ItemSequenceNumber	CompleteItemNumber	String	PlantItem
CompleteItemNumber	Comments	Comment	PlantItem
Comments	Notes	String	PlantItem
Notes	Description	String	PlantItem
Description	⊕ NormalDesignCriteria	DesignCriteria	PlantItem
⊕ NormalDesignCriteria	⊕ MinimumDesignCriteria	DesignCriteria	PlantItem
⊕ MinimumDesignCriteria	⊕ MaximumDesignCriteria	DesignCriteria	PlantItem
⊕ MaximumDesignCriteria	CaseName	String	PlantItem
CaseName	MaterialConstruction	ConstructionMaterial	PlantItem

FIG. 3G

FIG. 3H

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PressureRating	Real	32 ~	Pressure	Nozzle
TemperatureRating	Real		Temperature	Nozzle
FlangeVelocity	Real		Velocity	Nozzle
PressureDrop	Real		PressureDiff	Nozzle
RhoV2	Real		Density Velocity Sq	Nozzle
Velocity	Real		Velocity	Nozzle
AllowableForceAxial	Real		Force	Nozzle
AllowableForceHorizontal	Real		Force	Nozzle
AllowableForceVertical	Real		Force	Nozzle
AllowableMomentAxial	Real		Bending Moment/Torq	Nozzle
AllowableMomenHorizontal	Real		Bending Moment/Torq	Nozzle
AllowableMomentVertical	Real		Bending Moment/Torq	Nozzle
④DistributorBelt				Nozzle
④Flange			Flange	Nozzle
④Flanged			eFlanged(Nozzle)	Nozzle
④Gasket			Gasket	Nozzle
MatingPartsFurnished	Boolean			Nozzle
④NozzleDome			NozzleDome	Nozzle
④PipingTerminator			PipingTerminator	Nozzle
VortexBreaker	Boolean			Nozzle
Threaded	Boolean			Nozzle
ThreadedParameterA	Real		Length	Nozzle
ThreadedParameterB	Real		Length	Nozzle
ThreadedParameterC	Real		Length	Nozzle

FIG. 3I

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ThreadedParameterD	Real	Length	Nozzle
ThreadedParameterE	Real	Length	Nozzle
LinePipeMaterial	ConstructionMaterial	Nozzle	Nozzle
ReinforcingPlateMaterial	ConstructionMaterial	MechanicalComponent	MechanicalComponent
Remarks	String	ProcessPlantEquipment	ProcessPlantEquipment
NamePrecedent	String		
ApplicableTo	eApplicableTo(ProcessPlantEquipment)		

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FIG. 3J

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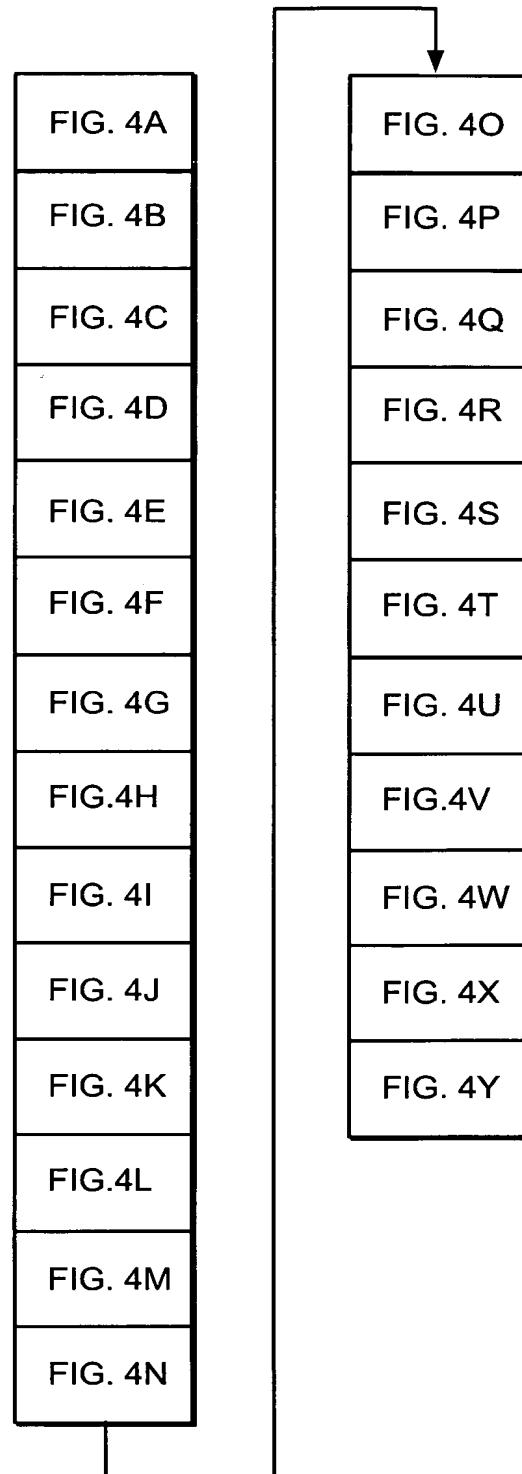


FIG. 4

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Name	Type	Quantity Type	Route	36
AdditionalRemarks	String		AdditionalRemarks	
BaffleCut	Real	Percentage PQI	Assemblies.Bundle.Baffles.BaffleCut	
BaffleCutOrientation	String		Assemblies.Bundle.Baffles.Orientation	
BaffleCutType	String			
BafflePercentageCutForAreaBasis	Real	Percentage	Assemblies.Bundle.Baffles.PercentAreaCut	
BafflePercentageCutForShellInnerDiameter	Real	Percentage	Assemblies.Bundle.Baffles.PercentDiameterFirstCut	
BafflePitch	Real	Length normal	Assemblies.Bundle.Baffles.Pitch	
BafflePitchMaximum	Real	Length small	Assemblies.Bundle.Baffles.MaterialOfConstruction.MaterialName	
BafflesAndSupportPlates	String			
BaffleShellDiametralClearance	Real	Length normal	Assemblies.Bundle.BaffleToShellClearance	
BafflesMaterial	String		Assemblies.Bundle.Baffle.MaterialOfConstruction.MaterialName	
BafflesNumber	Integer		Assemblies.Bundle.NumberOfBaffles	
BafflesNumberAllowable	String			
BafflesNumberMinimize	Boolean			
BaffleSpacing	Real	Length	Assemblies.Bundle.NominalBaffleSpacing	
BaffleSpacingFromInlet	Real	Length	Assemblies.Bundle.Tubesheets(1).DistanceFromFrontTubeSheetFace	
BaffleSpacingFromOutlet	Real			
BaffleSpacingMaximum	Real	Length small		
BaffleSpacingMinimum	Real	Length small		
BafflesPresent	String			
BaffleSpacersTieRodsCorrosionAllowance	Real	Length small	Assemblies.Bundle.Tubesheets(1).TieRods.MaterialOfConstruction.CorrosionAllowance	

FIG. 4A

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BaffleSpacersTierRodsMaterial	String		Assemblies.Bundle.Tubesheets(1).TierRods.MaterialOfConstruction.MaterialName
BaffleThickness	Real	Length small	Assemblies.Bundle.Baffles.Thickness
BaffleType	eType(ExchangerBaffle)	Assemblies.Bundle.Baffles.BaffleType	
BundleDiameter	Real	Length	
BundleEntranceRho2	Real	Density Velocity Sq	Assemblies.PerformanceCriteria.ShellSidePerformance.BundleEntranceRho2
BundleExitRho2	Real	Density Velocity Sq	Assemblies.PerformanceCriteria.ShellSidePerformance.BundleExitRho2
BundleFirstTubeRowToHoleDistance	Real	Length small	
BundleLastTubeRowToOutletDistance	Real	Length small	
BundleOuterDiameterMaximum	Real	Length (m)	Assemblies.Bundle.MaximumDesignCriteria(1).BundleOuterDiameter
BundleShellDiameterClearance	Real	Length small	
BundleWeight	Real	Mass	Assemblies.Bundle.Weights.TotalOperating
BundleNormalOfFull	String		
BypassSealRequired	Boolean		Assemblies.Bundle.BypassSeal.BypassSealRequired
BypassSealType	String		Assemblies.Bundle.BypassSeal.SealType
ChannelBodyFlangeMaterial	String		Assemblies.Channel.BodyFlangeMaterial.MaterialName
ChannelBodyFlangesCorrosionAllowance	Real	Length small	Assemblies.Channel.BodyFlangeMaterial.CorrosionAllowance
ChannelCorrosionAllowance	Real	Length small	Assemblies.Channel.ChannelMaterial.CorrosionAllowance
ChannelCoverCorrosionAllowance	Real	Length small	Assemblies.Channel.CoverMaterial.CorrosionAllowance
ChannelCoverMaterial	String		Assemblies.Channel.CoverMaterial.MaterialName
ChannelExitInsulationMaterial	String		Assemblies.Channel.ExitInsulationMaterial.MaterialName
ChannelExitInsulationThickness	Real	Length small	Assemblies.Channel.ExitInsulationMaterial.Thickness
ChannelExternalBoltingCorrosionAllowance	Real	Length small	Assemblies.Channel.ExternalBoltingMaterial.CorrosionAllowance
ChannelExternalBoltingMaterial	String		Assemblies.Channel.ExternalBoltingMaterial.MaterialName
ChannelHeadCorrosionAllowance	Real	Length small	Assemblies.Channel.CoverMaterial.CorrosionAllowance

FIG. 4B

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ChannelHeadMaterial	String	Assemblies.Channel.CoverMaterial.MaterialName
ChannelInletInsulationMaterial	String	Assemblies.Channel.InletInsulationMaterial.MaterialName
ChannelInletInsulationThickness	Real	Length small
ChannelInletBoltingCorrosionAllowance	Real	Length small
ChannelInternalBoltingMaterial	String	Assemblies.Channel.InternalBoltingMaterial.MaterialName
ChannelMaterial	String	Assemblies.Channel.ChanneMaterial.MaterialName
ChannelNozzleFlangeMaterial	String	Assemblies.Channel.NozzleFlangeMaterial.MaterialName
ChannelNozzleFlangeCorrosionAllowance	Real	Length small
ChannelNozzleNeckMaterial	String	Assemblies.Channel.NozzleNeckMaterial.MaterialName
ChannelNozzleNecksCorrosionAllowance	Real	Length small
ChannelNozzleReinforcementCorrosionAllowance	Real	Length small
ChannelNozzleReinforcementMaterial	String	Assemblies.Channel.NozzleReinforcementMaterial.MaterialName
ChannelPipeAndStubEndsCorrosionAllowance	Real	Length small
ChannelPipeAndStubEndsMaterial	String	Assemblies.Channel.PipeAndStubEndsMaterial.MaterialName
CodeRequirements	String	AsmeCode
ColdInletStream	MaterialFlowSpecification	MaterialPorts.ThermalAllocation="ColdIn".Flow
ColdOutletStream	MaterialFlowSpecification	MaterialPorts.ThermalAllocation="ColdOut".Flow
ColdSideDesignPressure	Real	Pressure abs
ColdSideDesignTemperature	Real	Temperature tmp
ColdSideFlangeFacing	String	ColdSide.FlangeFacing
ColdSideFlangeRating	String	ColdSide.FlangeRating
ColdSideFluidAllocation	eHotFluidAllocation(Shef)	NormalDesignCriteria(1).ColdFluidAllocation
ColdSideFluidName	String	MaterialPorts.ThermalAllocation="ColdIn".Flow Name
ColdSideFoulingResistance	Real	Thermal Resistance

FIG. 4C

ColdSideFoulingThickness	Real	Length small	ColdSide Fouling Thickness
ColdSideFullVacuum	Boolean		ColdSide NormalDesignCriteria FullVacuum
ColdSideGasketMaterial	String		
ColdSideHeatBalanceMethod	String		
ColdSideHeatCurves	ExchangeFluidProfile		ColdSide FluidProfiles[]
ColdSideInletH2MoleConcentration	Real	Enthalpy	MaterialPorts[ThermalAllocation="ColdIn"]Flow BulkFlow Enthalp/MassBasis
ColdSideInletH25MoleConcentration	Real	Condentm(Mol/Mol)	MaterialPorts[ThermalAllocation="ColdIn"]Flow BulkFlow DefinedPointPhysicalProperties_Hydrog
ColdSideInletInertMW	Real	Condentm(Mol/Mol)	MaterialPorts[ThermalAllocation="ColdIn"]Flow BulkFlow DefinedPointPhysicalProperties_Hydrog
ColdSideInletMassQuality	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="ColdIn"]Flow NonCondensibles.MolecularWeight
ColdSideInletPressure	Real	Fraction	MaterialPorts[ThermalAllocation="ColdIn"]Flow Vapour!Phase!MassFraction
ColdSideInletTemperature	Real	Pressure abs	MaterialPorts[ThermalAllocation="ColdIn"]Flow BulkFlow Pressure
ColdSideInletVaporH2MFLow	Real	Temperature Imp	MaterialPorts[ThermalAllocation="ColdIn"]Flow BulkFlow Temperature
ColdSideInletVaporH2MMW	Real	Mass flow normal	MaterialPorts[ThermalAllocation="ColdIn"]Flow Vapour!PhaseDefinedPointPhysicalProperties_Hy
ColdSideInletVaporH2OMW	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="ColdIn"]Flow Vapour!PhaseDefinedPointPhysicalProperties_Hy
ColdSideInletVaporHydrocarbonMassFlow	Real	Mass flow normal	MaterialPorts[ThermalAllocation="ColdIn"]Flow Vapour!PhaseDefinedPointPhysicalProperties_Hy
ColdSideInletVaporHydrocarbonMW	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="ColdIn"]Flow Vapour!PhaseDefinedPointPhysicalProperties_Hy
ColdSideLiquidHeatTransferCoefficientSpecified	Real	Heat Transfer Coef	
ColdSideMassFlow	Real	Mass flow normal	MaterialPorts[ThermalAllocation="ColdIn"]Flow BulkFlow MassFlowRate
ColdSideMolecularWeight	Real	Molar Mass	MaterialPorts[ThermalAllocation="ColdIn"]Flow BulkFlow MolecularWeight
ColdSideOutletEnthalpyMassBasis	Real	Enthalpy	MaterialPorts[ThermalAllocation="ColdOut"]Flow BulkFlow Enthalp/MassBasis
ColdSideOutletH2MoleConcentration	Real	Condentm(Mol/Mol)	MaterialPorts[ThermalAllocation="ColdOut"]Flow BulkFlow DefinedPointPhysicalProperties_Hydrog
ColdSideOutletH2SMoleConcentration	Real	Condentm(Mol/Mol)	MaterialPorts[ThermalAllocation="ColdOut"]Flow BulkFlow DefinedPointPhysicalProperties_H2sMo
ColdSideOutletInertMW	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="ColdOut"]Flow NonCondensibles.MolecularWeight

FIG. 4D

ColdSideOutletMassQuality	Real	Fraction	MaterialPorts[ThermalAllocation="ColdOut"] Flow VapourPhase MassFraction
ColdSideOutletPressure	Real	Pressure abs.	MaterialPorts[ThermalAllocation="ColdOut"] Flow BulkFlow Pressure
ColdSideOutletTemperature	Real	Temperature tmp	MaterialPorts[ThermalAllocation="ColdOut"] Flow BulkFlow Temperature
ColdSideOutletVaporH2MassFlow	Real	Mass flow normal	MaterialPorts[ThermalAllocation="ColdOut"] Flow VapourPhaseDefinedPointPhysicalProperties H
ColdSideOutletVaporH2MW	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="ColdOut"] Flow VapourPhaseDefinedPointPhysicalProperties H
ColdSideOutletVaporH20MW	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="ColdOut"] Flow VapourPhaseDefinedPointPhysicalProperties H
ColdSideOutletVaporHydrocarbonMassFlow	Real	Mass flow normal	MaterialPorts[ThermalAllocation="ColdOut"] Flow VapourPhaseDefinedPointPhysicalProperties H
ColdSideOutletVaporHydrocarbonMW	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="ColdOut"] Flow VapourPhaseDefinedPointPhysicalProperties H
ColdSidePhaseIndicator	eForm[MaterialFlowSpec		MaterialPorts[ThermalAllocation="ColdOut"] Flow Form
ColdSidePressureDrop	Real	Pressure Diff.	ColdSide Normal Operating Criteria Pressure Drop
ColdSidePressureDropAllowable	Real	Pressure Diff.	ColdSide Maximum Design Criteria Allowable Pressure Drop
ColdSidePressureDropInNozzlesAllowable	Real		
ColdSideTestPressure	Real	Pressure abs	
ColdSideTestPressure	Real	Pressure abs	
ColdSideTwoPhaseHeatTransferCoefficientSpecified	Real	Heat Transfer Coef	
ColdSideVacuumPressure	Real	Pressure vacuum	
ColdSideVacuumReferenceTemperature	Real	Temperature tmp	ColdSide Normal Design Criteria Vacuum Temperature
ColdSideVapourHeatTransferCoefficientSpecified	Real	Heat Transfer Coef	
ColdSideVelocityMaximumAllowable	Real	Velocity normal	
ColdSideVelocityMinimumAllowable	Real	Velocity normal	
ConnectionDescription	String	Nozzles(*) Description	
ConnectionFacing	eFacing(Flange)	Nozzles(*) Flange Facing	
ConnectionMark	String	Nozzles(*) NozzleMark	
ConnectionNumberRequired	Integer	Nozzles(*) Number Required	

FIG. 4E

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ConnectionRating	eRating(Nozzle)	Nozzles(*).Rating
ConnectionScheduleSize	Real	Length
CorrectedandweightedMtd	Real	Temperature Diff
Correctedmtd	Real	PerformanceCriteria.LmtdWeighted
CostingUserTag	String	PerformanceCriteria.LmtdCorrected
Customer	String	CostData.UserTag
Description	String	Customer.AbbreviatedName
DesignGuidelines	String	Description
DesignShellMeanMetaTemperature	Real	DesignGuidelines(1). Assemblies.ShellSide.Shell.NormalDesignCriteria(1).MetalTemperature
DesignShellPressure	Real	Pressure gauge
DesignTubeMeanMetaTemperature	Real	Assemblies.ShellSide.Shell.NormalDesignCriteria(1).Pressure
DesignTubePressure	Real	Temperature
DesignTubeSheetMeanMetaTemperature	Real	Assemblies.Bundle.TubeType(1).NormalDesignCriteria(1).MetalTemperature
DirectFieldCost	Real	Pressure gauge
ExchangersDoublePipe	Boolean	Currency
ExchangerType	String	CostData.DirectFieldCost
ExchangerWeightEmpty	Real	Currency
ExchangerWeightFullOrWater	Real	ExchangersDoublePipe
ExpansionJointDesignLifeCycles	Integer	ExchangerType
ExpansionJointMaterial	String	Mass
ExpansionJointRequired	Boolean	Weights.Empty
ExpansionJointType	eType(ExpansionJoint)	Mass
Fabricator	String	Weights.WaterFilled
FloatingHeadCoverBottomMaterial	String	Assemblies.ShellSide.ExpansionJoints.DesignLifeCycles
		Assemblies.ShellSide.ExpansionJoints.MaterialOfConstruction.MaterialName
		Assemblies.ShellSide.ExpansionJoints.JointsRequired
		Assemblies.ShellSide.ExpansionJoints.JointType
		Fabricator
		Assemblies.FloatingHead.CoverBottomMaterial.MaterialName

FIG. 4F

FloatingHeadCoverMaterial	String		Assemblies.FloatingHead.CoverBoltMaterial.MaterialName
FloatingHeadGasketMaintenanceFactor	Real	Pressure abs	Assemblies.FloatingHead.Gasket.MaintenanceFactor
FloatingHeadGasketMaterial	String	Length small	Assemblies.FloatingHead.Gasket.MaterialOfConstruction.MaterialName
FloatingHeadGasketThickness	Real	Pressure abs	Assemblies.FloatingHead.Gasket.MaterialOfConstruction.Thickness
FloatingHeadGasketYFactor	Real	Assemblies.FloatingHead.Gasket.MaterialOfConstruction.MaximumYieldStrength	
FrontEndTempType	eTempType[ExchangeE		Assemblies.Ends(1).TempType
GasketsSparesSetsRequired	Integer		Assemblies.Gasket.NumberOfSpares
GeneralOfficeOverhead	Real	Currency	CostData.GeneralOfficeOverhead
HeatExchanged	Real	Power normal	PerformanceCriteria.PerformanceData(1).HeatDuty
HeatTransferRateClean	Real	Heat Transfer Coef	PerformanceCriteria.OverallCoefficientClean
HeatTransferRateFouled	Real	Heat Transfer Coef	PerformanceCriteria.OverallCoefficientFouled
HeatTransferRateRequired	Real		
HotInletStream	MaterialFlowSpecification	MaterialPorts[ThermalAllocation="HotIn"]Flow	
HotOutletStream	MaterialFlowSpecification	MaterialPorts[ThermalAllocation="HotOut"]Flow	
HotSideDesignPressure	Real	Pressure abs	HotSide.NormalDesignCriteria.Pressure
HotSideDesignTemperature	Real	Temperature Imp	HotSide.NormalDesignCriteria.Temperature
HotSideEnthalpy	Real	Enthalpy	HotSide.HeatingCoolingCurve(1).DataPoints("BulkFlow_ThermodynamicProperties_SpecificEnthalpy")
HotSideFlangeFacing	String		HotSide.FlangeFacing
HotSideFlangeFacing	String		HotSide.FlangeFacing
HotSideFlangeRating	String		HotSide.FlangeRating
HotSideFluidAllocation	eHotFluidAllocation[She		NormalDesignCriteria(1).HotFluidAllocation
HotSideFluidName	String		MaterialPorts[ThermalAllocation="HotIn"]Flow.Name
HotSideFoulingResistance	Real		Thermistist PCT
HotSideFoulingThickness	Real		Length small

FIG. 4G

HotSideFullVacuum	Boolean			HotSide, NormalDesignCriteria, FullVacuum
HotSideFullVacuumReferenceTemperature	Real	Temperature	TempreatureImp	HotSide, NormalDesignCriteria, Vacuum temperature
HotSideGasketMaterial	String			
HotSideHeatBalanceMethod	String			
HotSideHeatCurves	ExchangerFluidProfile			HotSide, FluidProfiles(*)
HotSideInletEnthalpyMassBasis	Real	Enthalpy		MaterialPorts[ThermalAllocation="HotIn"]Flow,BulkFlow,EnthalpyMassBasis
HotSideInletH2MoleConcentration	Real	Conc. % mol/mol		MaterialPorts[ThermalAllocation="HotIn"]Flow,BulkFlow,DefinedPointPhysicalProperties,Hydrogen
HotSideInletH2SMoleConcentration	Real	Conc. % mol/mol		MaterialPorts[ThermalAllocation="HotIn"]Flow,BulkFlow,DefinedPointPhysicalProperties,H2sMole
HotSideInletHettMW	Real	MolarMass (g/mol)		MaterialPorts[ThermalAllocation="HotIn"]Flow,NonCondensibles,MolecularWeight
HotSideInletMassQuality	Real	Fraction		MaterialPorts[ThermalAllocation="HotIn"]Flow,VapourPhase,MassFraction
HotSideInletPressure	Real	Pressure abs		MaterialPorts[ThermalAllocation="HotIn"]Flow,BulkFlow,Pressure
HotSideInletTemperature	Real	Temperature	TempreatureImp	MaterialPorts[ThermalAllocation="HotIn"]Flow,BulkFlow,Temperature
HotSideInletVaporFlowRate	Real	Mass flow small		MaterialPorts[ThermalAllocation="HotIn"]Flow,VapourPhase,MassFlowRate
HotSideInletVaporH2MassFlow	Real	Mass flow normal		MaterialPorts[ThermalAllocation="HotIn"]Flow,VapourPhase,DefinedPoint,PhysicalProperties,Hydrogen
HotSideInletVaporH2MW	Real	Molar Mass(g/mol)		MaterialPorts[ThermalAllocation="HotIn"]Flow,VapourPhase,DefinedPoint,PhysicalProperties,Hydrogen
HotSideInletVaporH20MW	Real	Molar Mass(g/mol)		MaterialPorts[ThermalAllocation="HotIn"]Flow,VapourPhase,DefinedPoint,PhysicalProperties,Hydrogen
HotSideInletVaporHydrocarbonMassFlow	Real	Mass flow normal		MaterialPorts[ThermalAllocation="HotIn"]Flow,VapourPhase,DefinedPoint,PhysicalProperties,Hydrocarbons
HotSideInletVaporHydrocarbonMW	Real	Molar Mass(g/mol)		MaterialPorts[ThermalAllocation="HotIn"]Flow,VapourPhase,DefinedPoint,PhysicalProperties,Hydrocarbons
HotSideLiquidHeatTransferCoefficientSpecified	Real	Heat Transfer Coef		
HotSideMassFlow	Real	Mass flow normal		MaterialPorts[ThermalAllocation="HotIn"]Flow,BulkFlow,MassFlowRate
HotSideMolecularWeight	Real	Molar Mass		MaterialPorts[ThermalAllocation="HotIn"]Flow,BulkFlow,MolecularWeight
HotSideOutletEnthalpyMassBasis	Real	Enthalpy		MaterialPorts[ThermalAllocation="HotOut"]Flow,BulkFlow,EnthalpyMassBasis
HotSideOutletH2MoleConcentration	Real	Conc. % mol/mol		MaterialPorts[ThermalAllocation="HotOut"]Flow,BulkFlow,DefinedPointPhysicalProperties,Hydrogen
HotSideOutletH2SMoleConcentration	Real	Conc. % mol/mol		MaterialPorts[ThermalAllocation="HotOut"]Flow,BulkFlow,DefinedPointPhysicalProperties,H2sMole

FIG. 4H

HotSideOutletInertMW	Real	MolarMass.(g/mol)	MaterialPorts[ThermalAllocation="HotOut"]Flow,NonCondensibles,MolecularWeight
HotSideOutletMassQuality	Real	Fraction	MaterialPorts[ThermalAllocation="HotOut"]Flow,VapourPhase,MassFraction
HotSideOutletPressure	Real	Pressure abs	MaterialPorts[ThermalAllocation="HotOut"]Flow,BulkFlow,Pressure
HotSideOutletTemperature	Real	Temperature	MaterialPorts[ThermalAllocation="HotOut"]Flow,BulkFlow,Temperature
HotSideOutletVaporH2MassFlow	Real	Mass flow normal	MaterialPorts[ThermalAllocation="HotOut"]Flow,VapourPhase,DefinedPoint,PhysicalProperties,Hyd
HotSideOutletVaporH2MW	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="HotOut"]Flow,VapourPhase,DefinedPoint,PhysicalProperties,Hyd
HotSideOutletVaporH20MW	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="HotOut"]Flow,VapourPhase,DefinedPoint,PhysicalProperties,H2
HotSideOutletVaporHydrocarbonMassFlow	Real	Mass flow normal	MaterialPorts[ThermalAllocation="HotOut"]Flow,VapourPhase,DefinedPoint,PhysicalProperties,Hy
HotSideOutletVaporHydrocarbonMW	Real	Molar Mass(g/mol)	MaterialPorts[ThermalAllocation="HotOut"]Flow,VapourPhase,DefinedPoint,PhysicalProperties,Hy
HotSidePhaseIndicator	eForm[MaterialFlowSpec]		MaterialPorts[ThermalAllocation="HotIn"]Flow,Form
HotSidePressureDrop	Real	Pressure Diff	HotSide,NormalOperatingCriteria,PressureDrop
HotSidePressureDropAllowable	Real	Pressure Diff	HotSide,MaximumDesignCriteria,AllowablePressureDrop
HotSidePressureDropInNozzlesAllowable	Real		
HotSideTestPressure	Real	Pressure abs	
HotSideTwoPhaseHeatTransferCoefficientSpecif	Real	Heat Transfer Coef	
HotSideVacuumPressure	Real	Pressure vacuum	
HotSideVapourHeatTransferCoefficientSpecified	Real	Heat Transfer Coef	
HotSideVelocityMaximumAllowable	Real	Velocity normal	
HotSideVelocityMinimumAllowable	Real	Velocity normal	
HydroTestPressureField	Real	Absolute Pressure	InspectionsAndTests,HydrostaticTestPressureField
HydroTestPressureShop	Real	Absolute Pressure	InspectionsAndTests,HydrostaticTestPressureShop
ImpingementProtection	Boolean		Assemblies,Bundle,ImpingementProtection
ImpingementProtectionType	ePlateType/Impingement		Assemblies,Bundle,ImpingementPlate,PlateType

FIG. 4I

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ImpingementProtectionType	ePlateType(Impingement)	Assemblies,Bundle,ImpingementPlate,PlateType
inletNozzleRv2	Real	Density,Velocity,Sq
InnerDiameter	Real	Length,normal,Assemblies,ShellSide,Performance,LimitInletRh0v2
InsulationDensity	Real	Density,Insulation,Density
InsulationMaterial	String	Insulation,MaterialName
InsulationPurpose	String	Insulation,Purpose
InsulationSpecification	String	Insulation,Specification
InsulationThickness	Real	Length,small,Insulation,Thickness
ItemNumber	String	ItemNumber
JobNo	String	JobNumber
KettleDiameterInner	Real	Length,small
KettleDiameterOuter	Real	Length,small
Location	String	Location,Site
LongitudinalBaffleSeatType	eSeatType(LongitudinalB	Assemblies,Bundle,LongitudinalBaffles,SeatType
LongitudinalBaffleType	String	Assemblies,Bundle,LongitudinalBaffles>Type
Manufacturer	String	Manufacturer
MaterialComponentCost	Real	CostData,MaterialComponentCost
MAWPCalculation	Boolean	CalculateMAWP
MAWPHotAndCorroded	Real	Pressure,abs,MAWPHotAndCorroded
MAWPNewAndCold	Real	Pressure,abs,MAWPNewAndCold
ModelNumber	String	ModelNumber
NormalShellMeanMetalTemperature	Real	Temperature,Assemblies,ShellSide,Shell,NormalDesignCriteria(1),MetalTemperature
NormalShellPressure	Real	Pressure,gauge,NormalContent,BulkAmount,Pressure
NormalTubeMeanMetalTemperature	Real	Temperature,Assemblies,Bundle,Tube>Type(1),NormalDesignCriteria(1),MetalTemperature

FIG. 4J

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NormalTubePressure	Real	Pressure gauge	NormalContents.BulkAmount,Pressure
NormalTubeSheetMeanMetalTemperature	Real	Temperature	Assemblies.Bundle.TubeType(1).NormalDesignCriteria(1).MetalTemperature
Notes	String	Notes(*)	
NumberOfCrossPasses	Integer	Assemblies.Bundle.NumberOfCrosspasses	
NumberOfUnits	Integer	NumberInService	
NumberRequired	Integer	NumberRequired	
Orientation	String	Orientation	
PONumber	String	PoNumber	
PressureShellDesignGauge	Real	Pressure gauge	NormalDesignCriteria(1).ShellSideDesign.Pressure
PressureTubeDesignGauge	Real	Pressure gauge	NormalDesignCriteria(1).ShellSideDesign.Pressure
PressureUnit	String	CompleteItemNumber	
Profit	Real	Currency	CostData.Profit
QuotedCost	Real	Currency	CostData.QuotedCost
RearEndTempType	eTempTypeExchanger	Assemblies.Ends(2).TempType	
ReasonsForStressRelief	String	InspectionAndTests.ReasonsForStressRelief	
RefNameIcarus	String	CostingReference	
SealingStripNumberOfPairs	Integer	Assemblies.Bundle.NumberOfSealStrips	
SealingStripTubeRowsPer	Real		
ServiceUnit	String	Function	
ShellAndTubeOnEquipmentSpecification	Boolean	ShellAndTubeOnEquipmentSpecification	
ShellAndTubeOnProcessSpecificationSS	Boolean	ShellAndTubeOnProcessSpecificationSS	
ShellBodyFlangeCorrosionAllowance	Real	Length.small	Assemblies.ShellSide.BodyFlangeMaterial.CorrosionAllowance
ShellBodyFlangeMaterial	String	Assemblies.ShellSide.BodyFlangeMaterial.MaterialName	
ShellCorrosionAllowance	Real	Length_inches	NormalDesignCriteria(1).ShellSideDesign.AllowableCorrosionAllowance

FIG. 4K

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ShellCoverMaterial	String	Assembles, ShellSide, CoverMaterial, MaterialName
ShellDiameterIncrements	Real	NormalDesignCriteria, ShellSideDesign, ShellDiameterIncrement
ShellDiameterInner	Real	Length, Assemblies, ShellSide, ShellInnerDiameter
ShellDiameterMaximum	Real	Length small, MaximumDesignCriteria, ShellSideDesign, MaximumShieldDiameter
ShellDiameterMinimum	Real	Length small, NormalDesignCriteria(1), ShellSideDesign, AllowableCorrosionAllowance
ShellDiameterMinimum	Real	Length small, NormaDesignCriteria(1), ShellsideDesign, AllowableCorrosionAllowance
ShellDiameterOuter	Real	Length, Assemblies, ShellSide, OuterDiameter
ShellExpansionJoint	String	Assemblies, ShellSide ExpansionJoints, MaterialOfConstruction, MaterialName
ShellExpansionJointCorrosionAllowance	Real	Length, Assemblies, ShellSide, ExpansionJoints, MaterialOfConstruction, CorrosionAllowance
ShellExternalBoltingCorrosionAllowance	Real	Length small, Assemblies, ShellSide, ExternalBoltingMaterial, CorrosionAllowance
ShellExternalBoltingMaterial	String	Assemblies, ShellSide, ExternalBoltingMaterial, MaterialName
ShellHeadCorrosionAllowance	Real	Length, Assemblies, ShellSide, Shell, Heads(1), MaterialOfConstruction, CorrosionAllowance
ShellHeadMaterial	String	Assemblies, ShellSide, Shell, Heads(1), MaterialOfConstruction, CorrosionAllowance
ShellInternalBoltingCorrosionAllowance	Real	Length small, Assemblies, ShellSide, InternalBoltingMaterial, CorrosionAllowance
ShellInternalBoltingMaterial	String	Assemblies, ShellSide, InternalBoltingMaterial, MaterialName
ShellMaterial	String	Assemblies, ShellSide, Shell, MaterialOfConstruction, MaterialName
ShellMaterialClass	String	Assemblies, ShellSide, MaterialOfConstruction, MaterialClass
ShellNozzleCorrosionAllowance	Real	Length small, Assemblies, ShellSide, NozzleFlangeMaterial, CorrosionAllowance
ShellNozzleFlangeMaterial	String	Assemblies, ShellSide, NozzleFlangeMaterial, MaterialName
ShellNozzleNeckMaterial	String	Assemblies, ShellSide, NozzleNeckMaterial, MaterialName
ShellNozzleNecksCorrosionAllowance	Real	Length small, Assemblies, ShellSide, NozzleNeckMaterial, CorrosionAllowance
ShellNozzleReinforcementCorrosionAllowance	Real	Length, Assemblies, ShellSide, Shell, Nozzles(1), MaterialOfConstruction, CorrosionAllowance
ShellNozzleReinforcementMaterial	String	Assemblies, ShellSide, Shell, Nozzles(1), Reinforced
ShellPassesNumberPerShell	Integer	Assemblies, ShellSide, Shell, NumberShellPasses

FIG. 4L

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<code>ShellPipeAndStubEndCorrosionAllowance</code>	<code>Real</code>	<code>Length small</code>	<code>Assemblies.ShellSide.PipeAndStubEnd.Material.CorrosionAllowance</code>
<code>ShellPipeAndStubEndMaterial</code>	<code>String</code>		<code>Assemblies.ShellSide.PipeAndStubEnd.Material.MaterialName</code>
<code>ShellSideAverageFilmCoefficient</code>	<code>Real</code>	<code>Heat Transfer Coef</code>	<code>Assemblies.PerformanceCriteria.ShellsidePerformance.BulkFilmCoefficient</code>
<code>ShellSideCleaning</code>	<code>String</code>		<code>Assemblies.ShellSide.MechanicalCleaning</code>
<code>ShellSideCorrosionAllowance</code>	<code>Real</code>	<code>Length</code>	<code>Assemblies.ShellSide.MaterialConstruction.CorrosionAllowance</code>
<code>ShellSideCrossflowFraction</code>	<code>Real</code>	<code>Fraction</code>	
<code>ShellSideDesignPressure</code>	<code>Real</code>	<code>Pressure gauge</code>	<code>Assemblies.ShellSide.NormalDesignCriteria(1).Pressure</code>
<code>ShellSideDesignPressureMaximum</code>	<code>Real</code>	<code>Pressure abs</code>	<code>Assemblies.ShellSide.MaximumDesignCriteria.Pressure</code>
<code>ShellSideDesignTemperature</code>	<code>Real</code>	<code>Temperature</code>	<code>Assemblies.ShellSide.NormalDesignCriteria(1).Temperature</code>
<code>ShellSideDesignTemperatureMaximum</code>	<code>Real</code>	<code>Temperature tmp</code>	<code>Assemblies.ShellSide.MaximumDesignCriteria.Temperature</code>
<code>ShellSideDrainNozzleNumber</code>	<code>Integer</code>		<code>Assemblies.ShellSide.Nozzles["Drain"].Number</code>
<code>ShellSideDrainNozzleRating</code>	<code>Real</code>		<code>Assemblies.ShellSide.Nozzles["DrainFunction="Drain"].Rating</code>
<code>ShellSideDrainNozzleSize</code>	<code>String</code>	<code>Length</code>	<code>Assemblies.ShellSide.Nozzles["DrainFunction="Drain].NominalSize</code>
<code>ShellSideFluidName</code>	<code>Real</code>		<code>MaterialPorts.PhysicalAllocation=ShellIn1.Flow.Name</code>
<code>ShellSideFoulingCoefficient</code>	<code>Real</code>	<code>Heat Transfer Coef</code>	<code>Assemblies.PerformanceCriteria.ShellsidePerformance.FoulingCoefficient</code>
<code>ShellSideFoulingResistance</code>	<code>Real</code>	<code>Thermal Resistance</code>	<code>Assemblies.PerformanceCriteria.ShellsidePerformance.FoulingResistance</code>
<code>ShellSideGasketMaintenanceFactor</code>	<code>Real</code>	<code>Pressure abs</code>	<code>Assemblies.ShellSide.Gasket.MaintenanceFactor</code>
<code>ShellSideGasketMaterial</code>	<code>String</code>		<code>Assemblies.Gasket.MaterialOfConstruction.MaterialName</code>
<code>ShellSideGasketThickness</code>	<code>Real</code>	<code>Length small</code>	<code>Assemblies.ShellSide.Gasket.BodyMaterial.Thickness</code>
<code>ShellSideGasketVFactor</code>	<code>Real</code>	<code>Pressure abs</code>	<code>Assemblies.ShellSide.Gasket.MinimumDesignSealingStress</code>
<code>ShellSideInletNozzleInsideDiameter</code>	<code>Real</code>	<code>Length small</code>	<code>Assemblies.ShellSide.Nozzles[NozzleFunction="Inlet"].Bore</code>
<code>ShellSideInletNozzleNumber</code>	<code>Integer</code>		<code>Assemblies.ShellSide.Nozzles[NozzleFunction="Inlet"].Number</code>
<code>ShellSideInletNozzleRating</code>	<code>Real</code>		<code>Assemblies.ShellSide.Nozzles[NozzleFunction="Inlet"].Rating</code>
<code>ShellSideInletNozzleRhoV2</code>	<code>Real</code>	<code>Density VelocitySq</code>	<code>Assemblies.ShellSide.Nozzles[NozzleFunction="Inlet"].RhoV2</code>

FIG. 4M

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ShellSideInletNozzleSize	Real	Length	Assemblies.ShellSide.Nozzles[NozzleFunction="Inlet"].NominalSize
ShellSideInletNozzleType	String		Assemblies.ShellSide.Nozzles[NozzleFunction="Inlet"].Type
ShellSideInletPressure	Real	Pressure abs	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,BulkFlow,Pressure
ShellSideInletTemperature	Real	Temperature Imp	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,BulkFlow,Temperature
ShellSideIntermediateNozzleNumber	Integer		Assemblies.ShellSide.Nozzles[NozzleFunction="Intermediate"],Number
ShellSideIntermediateNozzleRating	eNozzleRating1_PIP_VEC		Assemblies.ShellSide.Nozzles[NozzleFunction="Intermediate"],Rating
ShellSideIntermediateNozzleRhoV2	Real	Density Sq	Assemblies.ShellSide.Nozzles[NozzleFunction="Intermediate"],RhoV2
ShellSideIntermediateNozzleSize	Real	Length	Assemblies.ShellSide.Nozzles[NozzleFunction="Intermediate"],NominalSize
ShellSideIntermediateNozzleType	String		Assemblies.ShellSide.Nozzles[NozzleFunction="Intermediate"],Type
ShellSideLatentHeat	Real	Latent heat normal	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,BulkFlow,ThermodynamicProperties,HeatOfVapo
ShellSideLatentHeat	Real	Latent heat normal	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,BulkFlow,ThermodynamicProperties,HeatOfVapo
ShellSideLatentHeatReferenceTemperature	Real	Temperature	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,BulkFlow,TransportProperties,ReferenceTemper
ShellSideLiquidInletDensity	Real	Density	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,LiquidPhase,PvProperties,Density,MassBasis
ShellSideLiquidInletFlow	Real	Flow Rate(Mass)	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,LiquidPhase,MassFlowRate
ShellSideLiquidInletSpecificHeat	Real	Spec Heat Cap (Ma)	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,LiquidPhase,ThermodynamicProperties,HeatCap
ShellSideLiquidInletSurfaceTension	Real	Surface Tension	MaterialPorts[PhysicalAllocation="ShellIn"],Flow,LiquidPhase,TransportProperties,SurfaceTensi
ShellSideLiquidInletThermalConductivity	Real		ThermalConductivity
ShellSideLiquidInletViscosity	Real		MaterialPorts[PhysicalAllocation="ShellIn"],Flow,LiquidPhase,TransportProperties,Viscosity
ShellSideLiquidOutletDensity	Real	Density	MaterialPorts[PhysicalAllocation="ShellOut"],Flow,LiquidPhase,PvProperties,Density,MassBasis
ShellSideLiquidOutletFlow	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="ShellOut"],Flow,LiquidPhase,MassFlowRate
ShellSideLiquidOutletNozzleDiameter	Real	Length small	Assemblies.ShellSide.Nozzles[NozzleFunction="LiquidOutlet"],Bore
ShellSideLiquidOutletNozzleNumber	Integer		Assemblies.ShellSide.Nozzles[NozzleFunction="LiquidOutlet"],Number
ShellSideLiquidOutletNozzleRating	eNozzleRating1_PIP_VEC		Assemblies.ShellSide.Nozzles[NozzleFunction="LiquidOutlet"],Rating
ShellSideLiquidOutletNozzleRhoV2	Real	Density Sq	Assemblies.ShellSide.Nozzles[NozzleFunction="LiquidOutlet"],RhoV2

FIG. 4N

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ShellSideLiquidOutletNozzleType	String	Assemblies.ShellSide.Nozzles[NozzleFunction="LiquidOutlet"].Bore
ShellSideLiquidOutletSpecificHeat	Real	Spec Heat Cap Mat
ShellSideLiquidOutletSurfaceTension	Real	Surface tension PQ
ShellSideLiquidOutletThermalConductivity	Real	Thermal Conductivity
ShellSideLiquidOutletViscosity	Real	Dynamic Viscosity
ShellSideMinimumMetalTemperature	Real	Temperature
ShellSideNoncondensableInletFlow	Real	Flow Rate (Mass)
ShellSideNoncondensableInletMW	Real	Molar Mass
ShellSideNoncondensableOutletFlow	Real	Flow Rate (Mass)
ShellSideNoncondensableOutletMW	Real	Molar Mass
ShellSideNumberOfPassesPerShell	Integer	MaterialPorts[PhysicalAllocation="ShellIn"].Flow.NonCondensable.MassFlowRate
ShellSideOutletNozzleDiameter	Real	MaterialPorts[PhysicalAllocation="ShellIn"].Flow.NonCondensable.MolecularWeight
ShellSideOutletNozzleNumber	Integer	MaterialPorts[PhysicalAllocation="ShellOut"].Flow.NonCondensable.MassFlowRate
ShellSideOutletNozzleRating	eNozzleRating1_PIP_VEC	MaterialPorts[PhysicalAllocation="ShellOut"].Flow.NonCondensable.PIPProperties.MolecularWeight
ShellSideOutletNozzleRhoV2	Real	Assemblies.ShellSide.Nozzles.NumberOfPasses
ShellSideOutletNozzleSize	Real	Length
ShellSideOutletNozzleType	String	Assemblies.ShellSide.Nozzles[NozzleFunction="Outlet"].Bore
ShellSideOutletTemperature	Real	Assemblies.ShellSide.Nozzles[NozzleFunction="Outlet"].Number
ShellSidePressureDropAllowable	Real	Assemblies.ShellSide.Nozzles[NozzleFunction="Outlet"].Rating
ShellSidePressureDropCalculated	Real	Density Velocity Sq
ShellSideSteamInletFlow	Real	Assemblies.ShellSide.Nozzles[NozzleFunction="Outlet"].RhoV2
ShellSideSteamOutletFlow	Real	Length
ShellSideTestPressure	Real	Assemblies.ShellSide.Nozzles[NozzleFunction="Outlet"].NominalSize
ShellSideTotalFluidQuantity	Real	Assemblies.ShellSide.Nozzles[NozzleFunction="Outlet"].Type
		MaterialPorts[PhysicalAllocation="ShellOut"].Flow.BulkFlow.Temperature
		Assemblies.ShellSide.NormalOperatingCriteria(1).PressureDrop
		Assemblies.ShellSide.NormalOperatingCriteria(2).PressureDrop
		MaterialPorts[PhysicalAllocation="ShellIn"].Flow.Steam.MassFlowRate
		Mass flow normal
		MaterialPorts[PhysicalAllocation="ShellOut"].Flow.Steam.MassFlowRate
		Assemblies.ShellSide.InspectionAndTests.HydrostaticTestPressure
		MaterialPorts[PhysicalAllocation="ShellIn"].Flow.BulkFlow.MassFlowRate
		FlowRate(Mass)

FIG. 4O

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ShellSideVaporInletDensity	Real	Density	MaterialPorts[PhysicalAllocation="ShellIn"]Flow,VapourPhase,PvProperties,DensityMassBasis
ShellSideVaporInletFlow	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="ShellIn"]Flow,VapourPhase,MassFlowRate
ShellSideVaporInletMw	Real	Molar Mass	MaterialPorts[PhysicalAllocation="ShellIn"]Flow,VapourPhase,MolecularWeight
ShellSideVaporInletSpecificHeat	Real	Spec Heat Cap (Ma)	MaterialPorts[PhysicalAllocation="ShellIn"]Flow,VapourPhase,ThermodynamicProperties,HeatCap
ShellSideVaporInletThermalConductivity	Real	Thermal Conductivity	MaterialPorts[PhysicalAllocation="ShellIn"]Flow,VapourPhase,TransportProperties,ThermalConductivity
ShellSideVaporInletViscosity	Real	Dynamic Viscosity	MaterialPorts[PhysicalAllocation="ShellIn"]Flow,VapourPhase,TransportProperties,Viscosity
ShellSideVaporOutletDensity	Real	Density	MaterialPorts[PhysicalAllocation="ShellOut"]Flow,VapourPhase,PvProperties,DensityMassBasis
ShellSideVaporOutletFlow	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="ShellOut"]Flow,VapourPhase,MassFlowRate
ShellSideVaporOutletMw	Real	Molar Mass	MaterialPorts[PhysicalAllocation="ShellOut"]Flow,VapourPhase,PvProperties,MolecularWeight
ShellSideVaporOutletNozzleNumber	Integer	Assemblies,ShellSide,Nozzles,NozzleFunction="VapourOutlet",Number	
ShellSideVaporOutletNozzleRhoV2	Real	Density Velocity Sq	Assemblies,ShellSide,Nozzles,NozzleFunction="VapourOutlet",RhoV2
ShellSideVaporOutletNozzleSize	Real	Length small	Assemblies,ShellSide,Nozzles,NozzleFunction="VapourOutlet",NominalSize
ShellSideVaporOutletNozzleType	String		Assemblies,ShellSide,Nozzles,NozzleFunction="VapourOutlet",Type
ShellSideVaporOutletSpecificHeat	Real	Spec Heat Cap (Ma)	MaterialPorts[PhysicalAllocation="ShellOut"]Flow,VapourPhase,ThermodynamicProperties,HeatCap
ShellSideVaporOutletThermalConductivity	Real	Thermal Conductivity	MaterialPorts[PhysicalAllocation="ShellOut"]Flow,VapourPhase,TransportProperties,ThermalConductivity
ShellSideVaporOutletThermalConductivity	Real	Thermal Conductivity	MaterialPorts[PhysicalAllocation="ShellOut"]Flow,VapourPhase,TransportProperties,ThermalConductivity
ShellSideVaporOutletViscosity	Real	Dynamic Viscosity	MaterialPorts[PhysicalAllocation="ShellOut"]Flow,VapourPhase,TransportProperties,Viscosity
ShellSideVelocity	Real	Velocity	Assemblies,PerformanceCriteria,ShellSidePerformance,MicropointVelocity
ShellSideVelocityMaximum	Real	Velocity small	Assemblies,NormalDesignCriteria,ShellsideDesign,MaximumVelocity
ShellSideVentNozzleNumber	Integer		Assemblies,ShellSide,Nozzles,NozzleFunction="Vent",Number
ShellSideVentNozzleRating	eNozzleRating2_PIP_VE		Assemblies,ShellSide,Nozzles,NozzleFunction="Vent",Rating
ShellSideVentNozzleSize	Real	Length	Assemblies,ShellSide,Nozzles,NozzleFunction="Vent",NominalSize
ShellSideWaterInletFlow	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="ShellIn"]Flow,CoolingWater,MassFlowRate
ShellSideWaterOutletFlow	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="ShellOut"]Flow,CoolingWater,MassFlowRate

FIG. 4P

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ShellsInParallelMaximum	Integer	NormalDesignCriteria(1).MaximumShellsInParallel
ShellsInParallelMinimum	Integer	NormalDesignCriteria(1).MinimumShellsInParallel
ShellsInParallelNumber	Integer	NumberShellsInParallel
ShellsInSeriesMaximum	Integer	NumberDesignCriteria(1).MaximumShellsInSeries
ShellsInSeriesMinimum	Integer	NormalDesignCriteria(1).MinimumShellsInSeries
ShellsInSeriesNumber	Integer	NumberShellsInSeries
ShellsMultiple	Boolean	MultipleShells
ShellsperUnit	Integer	NumberShellsPerUnit
ShellSupportsCorrosionAllowance	Real	Length small
ShellSupportsMaterial	String	Assemblies.ShellSide.Shell.Support.MaterialOfConstruction.CorrosionAllowance
ShellTEMAType	eShellITEMAType	Assemblies.ShellSide.Shell.Support.MaterialOfConstruction.MaterialName
ShellThickness	Real	Length small
ShellThicknessMinimum	Real	Length
ShopManpowerCost	Real	Currency
ShopOverhead	Real	Currency
ShutdownShellMeanMetalTemperature	Real	Temperature
ShutdownTubePressure	Real	Pressure gauge
ShutdownTubeMeanMetalTemperature	Real	Temperature
ShutdownTubePressure	Real	Pressure gauge
ShutdownTubeSheetMeanMetalTemperature	Real	Temperature
ShutdownTubeSheetMeanMetalTemperature	Real	Assemblies.Bundle.TubeType(1).NormalDesignCriteria(1).MetalTemperature
StartupShellPressure	Real	Temperature
StartupShellMeanMetalTemperature	Real	Assemblies.Bundle.Tubeshells(1).NormalDesignCriteria(1).MetalTemperature
StartupTubePressure	Real	Pressure gauge
StartupTubeMeanMetalTemperature	Real	Temperature
StartupTubePressure	Real	Assemblies.Bundle.TubeType(1).NormalDesignCriteria(1).MetalTemperature

FIG. 4Q

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StartupTubeSteelMeanMetalTemperature	Real	Temperature	Assemblies.Bundle.TubeSheets(1).NormalDesignCriteria(1).MetalTemperature
Status	String	Status	
SteamOutShellMeanMetalTemperature	Real	Temperature	Assemblies.ShellSide.Shell.NormalDesignCriteria(1).SteamOutTemperature
SteamOutTubeMeanMetalTemperature	Real	Temperature	Assemblies.ShellSide.Shell.NormalDesignCriteria(1).SteamOutTemperature
SteamOutShellPressure	Real	Pressure gauge	Assemblies.ShellSide.Shell.NormalDesignCriteria(1).SteamOutPressure
SteamOutShellRequirement	Boolean		Assemblies.ShellSide.Shell.NormalDesignCriteria.SteamOutRequirement
SteamOutTemperature	Real	Temperature	Assemblies.ShellSide.Shell.NormalDesignCriteria.SteamOutTemperature
SteamOutTubeMeanMetalTemperature	Real	Temperature	Assemblies.Bundle.TubeType(1).NormalDesignCriteria(1).SteamOutTemperature
SteamOutTubePressure	Real	Pressure gauge	Assemblies.Bundle.TubeType(1).NormalDesignCriteria(1).SteamOutPressure
SteamOutTubeSheetMeanMetalTemperature	Real	Temperature	Assemblies.Bundle.TubeSheets(1).NormalDesignCriteria(1).SteamOutPressure
SurfaceExcessMinimum	Real	Area normal	Assemblies.Bundle.ShellSide.EffectiveArea
SurfacePerShellEffective	Real	Area	EffectiveSurfacePerUnit
SurfacePerUnitRequired	Real	Area normal	RequiredSurfacePerUnit
TEMAClass	String	TEMAClass	
TEMAOrientation	String	TEMAOrientation	
TEMARemarks	String	TEMARemarks	
TEMASize	String	Status	
TEMAType	String	Type	
TemperatureShellDesign	Real	Temperature tmf	NormalDesignCriteria(1).ShellSideDesign.Temperature
TemperatureTubeDesign	Real	Temperature tmf	NormalDesignCriteria(1).ShellSideDesign.Temperature
TemperatureTubeDesign	Real	Temperature tmf	NormalDesignCriteria(1).TubesideDesign.Temperature
TerminalStreams	MaterialFlowSpecification	MaterialPorts(1).PipingSystem	
TestRingRequired	Boolean	InspectionAndTests.TestRingRequired	
ThicknessShell	Real	Length small	Assemblies.ShellSide.Thickness

FIG. 4R

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TotalCost	Real	Currency	CostData.TotalCost
TubeBaffleUllmetraClearance	Real	Length normal	Assemblies.Bundle.TubeToBaffle.Clearance
TubeBWGAverage	Integer		Assemblies.Bundle.Tube Type{1}.BirminghamWireGauge
TubeBWGMinimum	Integer		Assemblies.Bundle.Tube Type{1}.BirminghamWireGaugeMinimum
TubeCorrosionAllowance	Real	Length Inches	NormalDesignCriteria{1}.TubeSideDesign.AllowableCorrosionAllowance
TubeFinDiameterOuter	Real	Length Inches	Assemblies.Bundle.Tube Type{1}.ExternalOuterDiameter
TubeFinDiameterRoot	Real	Length normal	Assemblies.Bundle.Tube Type{1}.ExternalRootDiameter
TubeFinHeight	Real	Length normal	Assemblies.Bundle.Tube Type{1}.ExternalHeight
TubeFinMaterial	String		Assemblies.Bundle.Tube Type{1}.ExternalMaterialOfConstruction.MaterialName
TubeFinPerUnitLength	Real	Inverse length	Assemblies.Bundle.Tube Type{1}.ExternalNumberOffinsPerUnitLength
TubeFinPitch	Real	Length normal	Assemblies.Bundle.Tube Type{1}.ExternalPitch
TubeFinThickness	Real	Length normal	Assemblies.Bundle.Tube Type{1}.ExternalAverageThickness
TubelinerEndLength	Real	Length normal	Assemblies.Bundle.Tube Type{1}.InletEndLength
TubelinerDiameter	Real	Length small	Assemblies.Bundle.Tube Type{1}.InnerDiameter
TubeLayout	eTubeLayoutExchange		Assemblies.Bundle.Tube Layout
TubeLayoutAlternate	eTubeLayoutExchange		Assemblies.Bundle.TubeLayoutAlternate
TubeLayoutSpec	eTubeLayoutExchange		Assemblies.Bundle.TubeLayoutSpec
TubeLength	Real	Length	Assemblies.Bundle.Tube Type{1}.TotalLength
TubeLengthIncrement	Real	Length small	NormalDesignCriteria{1}.TubeSideDesign.TubeLengthIncrement
TubeLengthMaximum	Real	Length small	NormalDesignCriteria{1}.TubeSideDesign.MaximumTubeLength
TubeLengthMinimum	Real	Length small	NormalDesignCriteria{1}.TubeSideDesign.MinimumTubeLength
TubeLengthStraight	Real	Length normal	Assemblies.Bundle.Tube Type{1}.StraightLength
TubeLengthUnfinedAtBaffles	Real	Length	
TubeMaterial	String		Assemblies.Bundle.Tube Type{1}.MaterialOfConstruction.MaterialName

FIG. 4S

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TubeMaterialClass	String	Assemblies.Bundle.TubeType(1).MaterialOfConstruction.MaterialName
TubeMaterialDensity	Real	Assemblies.Bundle.TubeType(1).MaterialOfConstruction.Density
TubeNumber	Integer	Assemblies.Bundle.TotalNumberOfTubes
TubeOuterDiameter	Real	Assemblies.Bundle.TotalType(1).OuterDiameter
TubeOuterDiameterAlternate	Real	Assemblies.Bundle.TubeType(1).OuterDiameterAlternate
TubeOuterEndlength	Real	Length normal
TubePassesIncrement	String	Assemblies.Bundle.TubeType(1).OuterEndlength
TubePassesNumberPerShell	Integer	Assemblies.Bundle.NumberTubesPassesPerShell
TubePassesNumberPerShellMaximum	Real	
TubePassesNumberPerShellMinimum	Real	
TubePitch	Real	Length
TubePitchAlternate	Real	Length normal
TubeCorrosionAllowance	Real	Length small
TubeSheetFloatingMaterial	String	Assemblies.Bundle.Tubesheets(2).MaterialOfConstruction.MaterialName
TubeSheetCorrosionAllowance	Real	Length
TubeSheetsMaterial	String	Assemblies.Bundle.Tubesheets(1).MaterialOfConstruction.MaterialName
TubeSheetThickness	Real	Assemblies.Bundle.Tubesheets(1).MaterialOfConstruction.Thickness
TubeSideAverageFilmCoefficient	Real	Heat Transfer Coef
TubeSideCleaning	String	Assemblies.Bundle.MechanicalCleaning
TubeSideCorrosionAllowance	Real	Length
TubeSideDesignPressure	Real	Assemblies.Bundle.TubeType(1).MaterialOfConstruction.CorrosionAllowance
TubeSideDesignPressureMaximum	Real	Pressure abs
TubeSideDesignTemperature	Real	Assemblies.Bundle.NormalDesignCriteria(1).Pressure
TubeSideDesignTemperatureMaximum	Real	Assemblies.Bundle.MaximumDesignCriteria.Pressure
TubeSideTemp	Temperature	Temperature tmp
TubeSideTemperatureMaximum	Real	Assemblies.Bundle.NormalDesignCriteria(1).Temperature
TubeSideTemperatureMinimum	Real	Assemblies.Bundle.MaximumDesignCriteria.Temperature

FIG. 4T

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TubeSideDrainNozzleNumber	Integer	Assemblies, Bundle, Nozzles[NozzleFunction="Drain"].Number
TubeSideDrainNozzleNumber	Integer	Assemblies, Bundle, Nozzles[NozzleFunction="Drain"].Number
TubeSideDrainNozzleRating	eNozzleRating2_PIP_VEC	Assemblies, Bundle, Nozzles[NozzleFunction="Drain"].Rating
TubeSideDrainNozzleSize	Real	Length
TubeSideFluidName	String	MaterialPorts[PhysicalAllocation=TubeIn].Flow.Name
TubeSideFoulingCoefficient	Real	Heat Transfer Coef
TubeSideFoulingResistance	Real	Thermal Resistance
TubeSideGasketMaintenanceFactor	Real	Pressure abs
TubeSideGasketMaterial	String	Assemblies, Bundle, Gasket, BodyMaterial.MaterialName
TubeSideGasketThickness	Real	Length small
TubeSideGasketFactor	Real	Pressure abs
TubeSideInletNozzleAngularPosition	Real	Plane Angle
TubeSideInletNozzleDistanceFromTubesheet	Real	Length
TubeSideInletNozzleInsideDiameter	Real	Length small
TubeSideInletNozzleNumber	Integer	Assemblies, Bundle, Nozzles[NozzleFunction="Inlet"].Bore
TubeSideInletNozzlePressureDrop	Real	Pressure
TubeSideInletNozzleRating	eNozzleRating2_PIP_VEC	Assemblies, Bundle, Nozzles[NozzleFunction="Inlet"].Rating
TubeSideInletNozzleRhoV2	Real	Density Velocity Sq.
TubeSideInletNozzleSize	Real	Length
TubeSideInletNozzleType	String	Assemblies, Bundle, Nozzles[NozzleFunction="Inlet"].Nominal Size
TubeSideInletNozzleWallThickness	Real	Length
TubeSideInletNozzlePressure	Real	Pressure abs
TubeSideInletTemperature	Real	Temperature tmp
TubeSideIntermediateNozzleNumber	Integer	Assemblies, Bundle, Nozzles[NozzleFunction="Intermediate"].Number

FIG. 4U

TubeSideIntermediateNozzleRating	eNozzleRating2_PIP_VEC	Assemblies.Bundle.Nozzles[NozzleFunction="Intermediate"].Rating
TubeSideIntermediateNozzleRhoV2	Real	Density.Velocity.Sq.
TubeSideIntermediateNozzleSize	Real	Length
TubeSideIntermediateNozzleType	String	Assemblies.Bundle.Nozzles[NozzleFunction="Intermediate"].NominalSize
TubeSideLatentHeat	Real	Assemblies.Bundle.Nozzles[NozzleFunction="Intermediate"].Type
TubeSideLatentHeatReferenceTemperature	Real	Latent heat normal
TubeSideLiquidInletDensity	Real	MaterialPorts[PhysicalAllocation="TubeIn"].Flow.BulkFlow.ThermodynamicProperties.HeatOn/Off
TubeSideLiquidInletFlow	Real	MaterialPorts[PhysicalAllocation="TubeIn"].Flow.BulkFlow.TransportProperties.ReferenceTemperature
TubeSideLiquidInletSpecificHeat	Real	MaterialPorts[PhysicalAllocation="TubeIn"].Flow.Liquid1Phase.PvtProperties.Density.MassBasis
TubeSideLiquidInletSurfaceTension	Real	MaterialPorts[PhysicalAllocation="TubeIn"].Flow.Liquid1Phase.MassFlowRate
TubeSideLiquidInletThermalConductivity	Real	MaterialPorts[PhysicalAllocation="TubeIn"].Flow.Liquid1Phase.SpecHeatCap.MB
TubeSideLiquidInletViscosity	Real	MaterialPorts[PhysicalAllocation="TubeIn"].Flow.Liquid1Phase.ThermodynamicProperties.HeatCapacity
TubeSideLiquidOutletDensity	Real	MaterialPorts[PhysicalAllocation="TubeOut"].Flow.Liquid1Phase.TransportProperties.ThermalConductivity
TubeSideLiquidOutletFlow	Real	Dynamic Viscosity
TubeSideLiquidOutletInsideDiameter	Real	MaterialPorts[PhysicalAllocation="TubeOut"].Flow.Liquid1Phase.PvtProperties.Viscosity
TubeSideLiquidOutletNozzleNumber	Integer	MaterialPorts[PhysicalAllocation="TubeOut"].Flow.Liquid1Phase.PvtProperties.Density.MassBasis
TubeSideLiquidOutletNozzleRating	eNozzleRating2_PIP_VEC	MaterialPorts[PhysicalAllocation="TubeOut"].Flow.Liquid1Phase.MassFlowRate
TubeSideLiquidOutletNozzleRhoV2	Real	MaterialPorts[PhysicalAllocation="TubeOut"].Flow.Liquid1Phase.SpecHeatCap.Bore
TubeSideLiquidOutletNozzleSize	Real	length small
TubeSideLiquidOutletNozzleType	String	Assemblies.Bundle.Nozzles[NozzleFunction="LiquidOutlet"].NominalSize
TubeSideLiquidOutletSpecificHeat	Real	Assemblies.Bundle.Nozzles[NozzleFunction="LiquidOutlet"].Type
TubeSideLiquidOutletThermalConductivity	Real	Assemblies.Bundle.Nozzles[NozzleFunction="LiquidOutlet"].NominalSize
TubeSideLiquidOutletViscosity	Real	MaterialPorts[PhysicalAllocation="TubeOut"].Flow.Liquid1Phase.TransportProperties.Viscosity
TubeSideMinimumDesignMetalTemperature	Real	MinimumDesignMateral1.MetalTemperature

FIG. 4V

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TubeSideNoncondensableInletFlow	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="TubeIn"]Flow, NonCondensables, MassFlowRate
TubeSideNoncondensableInletMw	Real	Molar Mass	MaterialPorts[PhysicalAllocation="TubeIn"]Flow, NonCondensables, MolecularWeight
TubeSideNoncondensableOutletFlow	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="TubeOut"]Flow, NonCondensables, MassFlowRate
TubeSideNoncondensableOutletMw	Real	Molar Mass	MaterialPorts[PhysicalAllocation="TubeOut"]Flow, NonCondensables, MolecularWeight
TubeSideOutletNozzleInsideDiameter	Real	Length	Assemblies.Bundle, Nozzles[NozzleFunction="Outlet"] Bore
TubeSideOutletNozzleNumber	Integer	Quantity_Type	Assemblies.Bundle, Nozzles[NozzleFunction="Outlet"] Number
TubeSideOutletNozzleNumber	Integer		Assemblies.Bundle, Nozzles[NozzleFunction="Outlet"] Number
TubeSideOutletNozzleRating	eNozzleRating2_PIP_VEC		Assemblies.Bundle, Nozzles[NozzleFunction="Outlet"] Rating
TubeSideOutletNozzleRho/2	Real	Density_Velocity_Sq.	Assemblies.Bundle, Nozzles[NozzleFunction="Outlet"] Rho/2
TubeSideOutletNozzleSize	Real	Length	Assemblies.Bundle, Nozzles[NozzleFunction="Outlet"] NominalSize
TubeSideOutletNozzleType	String		Assemblies.Bundle, Nozzles[NozzleFunction="Outlet"] Type
TubeSideOutletSurfaceTension	Real	Surface Tension	
TubeSideOutletTemperature	Real	Temperature_tmP	MaterialPorts[PhysicalAllocation="TubeOut"]Flow, BulkFlow, Temperature
TubeSidePassesMaximum	Real		
TubeSidePassesMinimum	Real		
TubeSidePassesNumberPerStell	Integer	NumberTubePasses	
TubeSidePressureDropAllowable	Real	Pressure_Diff	Assemblies.Bundle, NormalDesignCriteria, PressureDrop
TubeSidePressureDropCalculated	Real	Pressure_Diff	Assemblies.Bundle, NormalOperatingCriteria, PressureDrop
TubeSideSteamInletFlow	Real	Flow Rate(Mass)	MaterialPorts[PhysicalAllocation="TubeIn"]Flow, Steam, MassFlowRate
TubeSideSteamOutletFlow	Real	Flow Rate(Mass)	MaterialPorts[PhysicalAllocation="TubeOut"]Flow, Steam, MassFlowRate
TubeSideTestPressure	Real	Pressure_abs	Assemblies.Bundle, InspectionAndTests, HydrostaticTestPressure
TubeSideTotalFluidQuantity	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="TubeIn"]Flow, BulkFlow, MassFlowRate
TubeSideVapourInDensity	Real	Density	MaterialPorts[PhysicalAllocation="TubeIn"]Flow, VapourInPhase, PdProperties, DensityMassBasis
TubeSideVapourInFlow	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="TubeIn"]Flow, VapourInPhase, MassFlowRate

FIG. 4W

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TubeSideVaporInletFlow	Real	Molar Mass	MaterialPorts[PhysicalAllocation="TubeIn"].Flow.VapourPhase.MolecularWeight
TubeSideVaporInletSpecificHeat	Real	Spec Heat Cap/Ma	MaterialPorts[PhysicalAllocation="TubeIn"].Flow.VapourPhase.ThermodynamicProperties.HeatCap
TubeSideVaporInletThermalConductivity	Real	Thermal Conductivity	MaterialPorts[PhysicalAllocation="TubeIn"].Flow.VapourPhase.TransportProperties.ThermalConc
TubeSideVaporInletViscosity	Real	Dynamic Viscosity	MaterialPorts[PhysicalAllocation="TubeIn"].Flow.VapourPhase.TransportProperties.Viscosity
TubeSideVaporOutletDensity	Real	Density	MaterialPorts[PhysicalAllocation="TubeOut"].Flow.VapourPhase.PMProperties.DensityMassBasis
TubeSideVaporOutletFlow	Real	Flow Rate (Mass)	MaterialPorts[PhysicalAllocation="TubeOut"].Flow.VapourPhase.MassFlowRate
TubeSideVaporOutletMW	Real	Molar Mass	MaterialPorts[PhysicalAllocation="TubeOut"].Flow.VapourPhase.MolecularWeight
TubeSideVaporOutletNozzleRhoV2	Real	Density Velocity Sq	Assemblies.Bundle.Nozzles[NozzleFunction="VaporOutlet"].RhoV2
TubeSideVaporOutletNozzleSize	Real	Length small	Assemblies.Bundle.Nozzles[NozzleFunction="VaporOutlet"].NominalSize
TubeSideVaporOutletNozzleType	String		Assemblies.Bundle.Nozzles[NozzleFunction="VaporOutlet"].Type
TubeSideVaporOutletSpecificHeat	Real	Spec Heat Cap/Ma	MaterialPorts[PhysicalAllocation="TubeOut"].Flow.VapourPhase.ThermodynamicProperties.HeatC
TubeSideVaporOutletThermalConductivity	Real	Thermal Conductivity	MaterialPorts[PhysicalAllocation="TubeOut"].Flow.VapourPhase.TransportProperties.ThermalCon
TubeSideVaporOutletViscosity	Real	Dynamic Viscosity	MaterialPorts[PhysicalAllocation="TubeOut"].Flow.VapourPhase.TransportProperties.Viscosity
TubeSideVelocity	Real	Velocity	Assemblies.PerformanceCriteria.TubesidePerformance.MidpointVelocity
TubeSideVentNozzleNumber	Integer		Assemblies.Bundle.Nozzles[NozzleFunction="Vent"].Number
TubeSideVentNozzleRating	String		Assemblies.Bundle.Nozzles[NozzleFunction="Vent"].Rating
TubeSideVentNozzleSize	Real	Length	Assemblies.Bundle.Nozzles[NozzleFunction="Vent"].NominalSize
TubeSideWaterInletFlow	Real	Flow Rate(Mass)	MaterialPorts[PhysicalAllocation="TubeIn"].Flow.CoolingWater.MassFlowRate
TubeSideWaterOutletFlow	Real	Flow Rate(Mass)	MaterialPorts[PhysicalAllocation="TubeOut"].Flow.CoolingWater.MassFlowRate
TubesInWindowNumberOf	Real	Plane Angle	Assemblies.Bundle.Slope
TubeSlope	Real		Assemblies.Bundle.Support Type
TubeSupport	String		Assemblies.Bundle.TubeType[1].MaterialOfConstruction.ThermalConductivity
TubeThermalConductivity	Real	Thermal Conductivity	Assemblies.Bundle.TubeType[1].WallThickness
TubeThickness	Real	Length	

FIG. 4X

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TubeThicknessAlternate	Real	Length small	Assemblies.Bundle.TubeType(1).WallThicknessAlternate
TubeThicknessUnderFins	Real	Length small	
TubeToTubesheetJoint	eTubeToTubesheetJoint		Assemblies.Bundle.Tubesheets(1).TubeToTubesheetJoint
TubeType	eType[ExchangerTube]		Assemblies.Bundle.TubeType(1).Tube Type
TubeYoungModulus	Real	Stress	Assemblies.Bundle.TubeType(1).MaterialOfConstruction.ElasticModulus
UBendRadius	Real	Length small	
UBendSupportDescription	String		Assemblies.Bundle.UBendSupport.Description
UBendSupportType	eType[UBendSupport]		Assemblies.Bundle.UBendSupport.SupportType
Upset1ShellMeanMetalTemperature	Real	Temperature	Assemblies.ShellSide.Shell.NormalDesignCriteria(1).Metal Temperature
Upset1ShellPressure	Real	Pressure gauge	Assemblies.ShellSide.Shell.NormalDesignCriteria(1).Pressure
Upset1TubeMeanMetalTemperature	Real	Temperature	Assemblies.Bundle.TubeType(1).NormalDesignCriteria(1).Metal Temperature

FIG. 4Y



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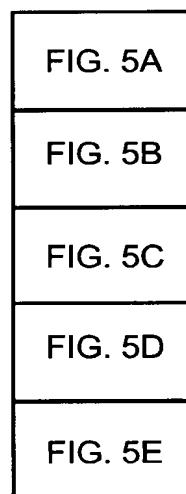


FIG. 5

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Class View PIP VED500S'				
	Name	Type	Quantity Type	Link
+ N	DatasheetObjectHeader	DatasheetObject		
- N	Page1			
+ N	HeaderData			
= N	PerformanceOfOneUnit			
= N	ShellSide			
	A FluidName	String		ShellAndTubeExchanger,ShellSideFluidName
	A TotalFluidQuantity	Real	FlowRate(kg/h)	ShellAndTubeExchanger,ShellSideTotalFluidQuantity
	A FlowRate			
+ N	MolecularWeight	Real	Temperature(C)	ShellAndTubeHeatExchanger,ShellSideInletTemperature
A	InletTemperature	Real	Temperature(C)	ShellAndTubeHeatExchanger,ShellSideOutletTemperature
A	OutletTemperature	Real		
+ N	Density			
+ N	Viscosity			
+ N	SpecificHeat			
+ N	ThermalConductivity			
A	LatentHeat	Real	CalorificVal(kJ/kg)	ShellAndTubeHeatExchanger,ShellSideLatentHeat
A	LatentHeatReferenceTemperature	Real	Temperature(C)	ShellAndTubeHeatExchanger,ShellSideReferenceTemperature
A	InletPressure	Real	PressureAbsolute	ShellAndTubeHeatExchanger,ShellSideInletPressure
A	Velocity	Real	Velocity(m/s)	ShellAndTubeHeatExchanger,ShellSideVelocity
A	AllowablePressureDrop	Real	PressureDiff(Mpa)	ShellAndTubeHeatExchanger,ShellSidePressureDropAllowable
A	CalculatedPressureDrop	Real	PressureDiff(Mpa)	ShellAndTubeHeatExchanger,ShellSidePressureDropCalculated

FIG. 5A

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A FoulingResistance	Real	Fouling Resistance	ShellAndTubeExchanger,ShellSideFoulingResistance
A AverageFilmCoefficient	Real	Heat Transfer Coef	ShellAndTubeExchanger,ShellSideAverageFilmCoefficient
+N TubeSide			
A FluidName	String		ShellAndTubeExchanger,TubeSideFluidName
A TotalFluidQuantity	Real	FlowRate(kg/h)	ShellAndTubeExchanger,TubeSideTotalFluidQuantity
+N FlowRate			
+N MolecularWeight			
A VaporInletMW	Real	Molar Mass	ShellAndTubeHeatExchanger,TubeSideVaporInletMW
A VaporOutletMW	Real	Molar Mass	ShellAndTubeHeatExchanger,TubeSideVaporOutletMW
A NoncondensableInletMW	Real	Molar Mass	ShellAndTubeHeatExchanger,TubeSideNoncondensableInletMW
A NoncondensableOutletMW	Real	Molar Mass	ShellAndTubeHeatExchanger,TubeSideNoncondensableOutletMW
A Inlet Temperature	Real	Temperature(C)	ShellAndTubeHeatExchanger,TubeSideInletTemperature
A Outlet Temperature	Real	Temperature(C)	ShellAndTubeHeatExchanger,TubeSideOutletTemperature
+N Density		Density	ShellAndTubeHeatExchanger,TubeSideVaporInletDensity
A VaporInletDensity	Real	Density	ShellAndTubeHeatExchanger,TubeSideVaporOutletDensity
A LiquidInletDensity	Real	Density	ShellAndTubeHeatExchanger,TubeSideLiquidInletDensity
A VaporOutletDensity	Real	Density	ShellAndTubeHeatExchanger,TubeSideVaporOutletDensity
A LiquidOutletDensity	Real	Density	ShellAndTubeHeatExchanger,TubeSideLiquidOutletDensity
+N Viscosity			
+N SpecificHeat			
+N ThermalConductivity			
A LatentHeat	Real	Calorific Val(kJ/kg)	ShellAndTubeHeatExchanger,TubeSideLatentHeat
A LatentHeatReference Temperature	Real	Temperature(C)	ShellAndTubeHeatExchanger,TubeSideLatentHeatReferenceTemperature
A InletPressure	Real	Pressure Absolute	ShellAndTubeHeatExchanger,TubeSideInletPressure
A Velocity	Real	Velocity (m/s)	ShellAndTubeHeatExchanger,TubeSideVelocity

FIG. 5B

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Class View 'HetranExchangerInput'			
Name	Type	Quantity Type	Link
A DBNAME	String		ShellAndTubeHeatExchanger,ItemNumber
A INDEX	String		ShellAndTubeHeatExchanger,ItemNumber
=N ProblemDefinition			
A DBNAME	String		ShellAndTubeHeatExchanger,ItemNumber
+N Description			
+N ApplicationOptions			
=N ProcessData			
A DBNAME	String		ShellAndTubeHeatExchanger,ItemNumber
+N ProcessDataTab			
+N HeatLoadBalanceOptions			
+F N PhysicalPropertyData			
+F N ExchangerGeometry			
A DBNAME	String		ShellAndTubeHeatExchanger,ItemNumber
+N Exchanger			
+N Tubes			
=N Bundle			
A DBNAME	String		ShellAndTubeHeatExchanger,ItemNumber
+N ShellInletOutlet			
+N Impingement			
+A IMPROTYPE	eHtranImpProType		ShellAndTubeHeatExchanger,ImpingementProtectionType
+N LayoutOptions			
+N LayoutLimits			
+N Clearances			
=N Baffles			

FIG. 5C

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<input checked="" type="checkbox"/> A DBNAME	String		ShellAndTubeHeatExchanger.ItemNumber
<input checked="" type="checkbox"/> N BafflesTab			
<input checked="" type="checkbox"/> A BAFTYPE	eHtranBaftype		
<input checked="" type="checkbox"/> A BAFCUTPERC	Real	Percentage PQT	ShellAndTubeHeatExchanger.BaffleCut
<input checked="" type="checkbox"/> A BAFORE	String		ShellAndTubeHeatExchanger.BaffleCutOrientation
<input checked="" type="checkbox"/> N TubeSupports			
<input checked="" type="checkbox"/> N RatingSimulationData			
<input checked="" type="checkbox"/> A DBNAME	String		ShellAndTubeHeatExchanger.ItemNumber
<input checked="" type="checkbox"/> N RatingSimulationGeometry			
<input checked="" type="checkbox"/> A SHLID	Real	Length small	ShellAndTubeHeatExchanger.ShellDiameterInner
<input checked="" type="checkbox"/> A SHLOD	Real	Length small	ShellAndTubeHeatExchanger.ShellDiameterOuter
<input checked="" type="checkbox"/> A BAFFSPCC	Real	Length small	ShellAndTubeHeatExchanger.BaffleSpacing
<input checked="" type="checkbox"/> A BAFFSPCN	Real	Length small	ShellAndTubeHeatExchanger.BaffleSpacingFromInlet
<input checked="" type="checkbox"/> A BAFFSCOUT	Real	Length small	ShellAndTubeHeatExchanger.BaffleSpacingFromOutlet
<input checked="" type="checkbox"/> A BAFNUM	Integer		ShellAndTubeHeatExchanger.BafflesNumber
<input checked="" type="checkbox"/> A TUBING	Real	Length small	ShellAndTubeHeatExchanger.TubeLengthStraight
<input checked="" type="checkbox"/> A TUBENUM	Integer		ShellAndTubeHeatExchanger.TubeNumber
<input checked="" type="checkbox"/> A TUBESESSNUM	Integer		ShellAndTubeHeatExchanger.TubePassesNumberPerShell
<input checked="" type="checkbox"/> A SHLSERNUM	Integer		ShellAndTubeHeatExchanger.ShellsInSeriesNumber
<input checked="" type="checkbox"/> A SHLPARNUM	Integer		ShellAndTubeHeatExchanger.ShellsInParallelNumber
<input checked="" type="checkbox"/> N KettleVapourBelt			
<input checked="" type="checkbox"/> A KETL0D	Real	Length small	ShellAndTubeHeatExchanger.KettleDiameterOuter
<input checked="" type="checkbox"/> A KETL1D	Real	Length small	ShellAndTubeHeatExchanger.KettleDiameterInner
<input checked="" type="checkbox"/> A VAPBLT0D	Real	Length small	ShellAndTubeHeatExchanger.VaporBellDiameterOuter
<input checked="" type="checkbox"/> A VAPBLT1D	Real	Length small	ShellAndTubeHeatExchanger.VaporBellDiameterInner

FIG. 5D

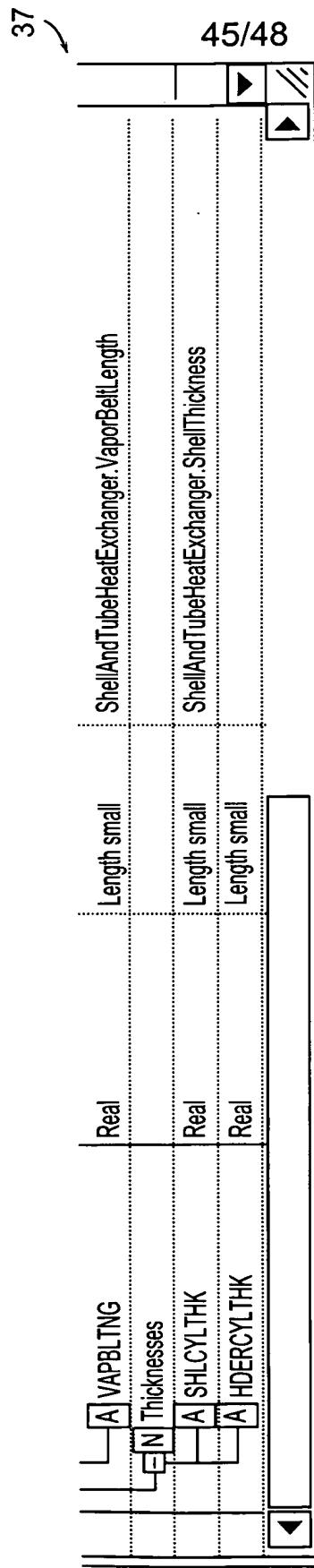


FIG. 5E

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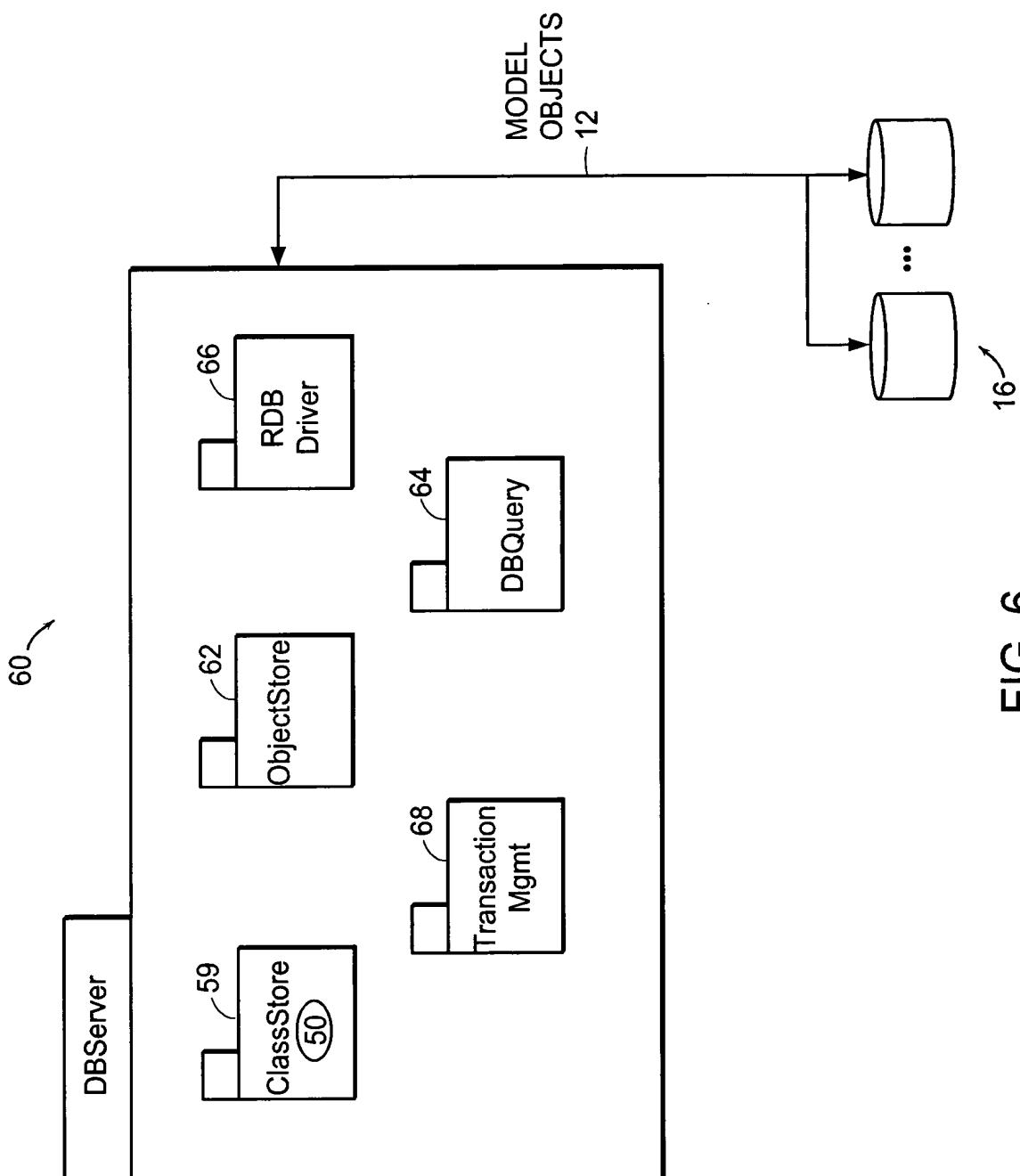


FIG. 6

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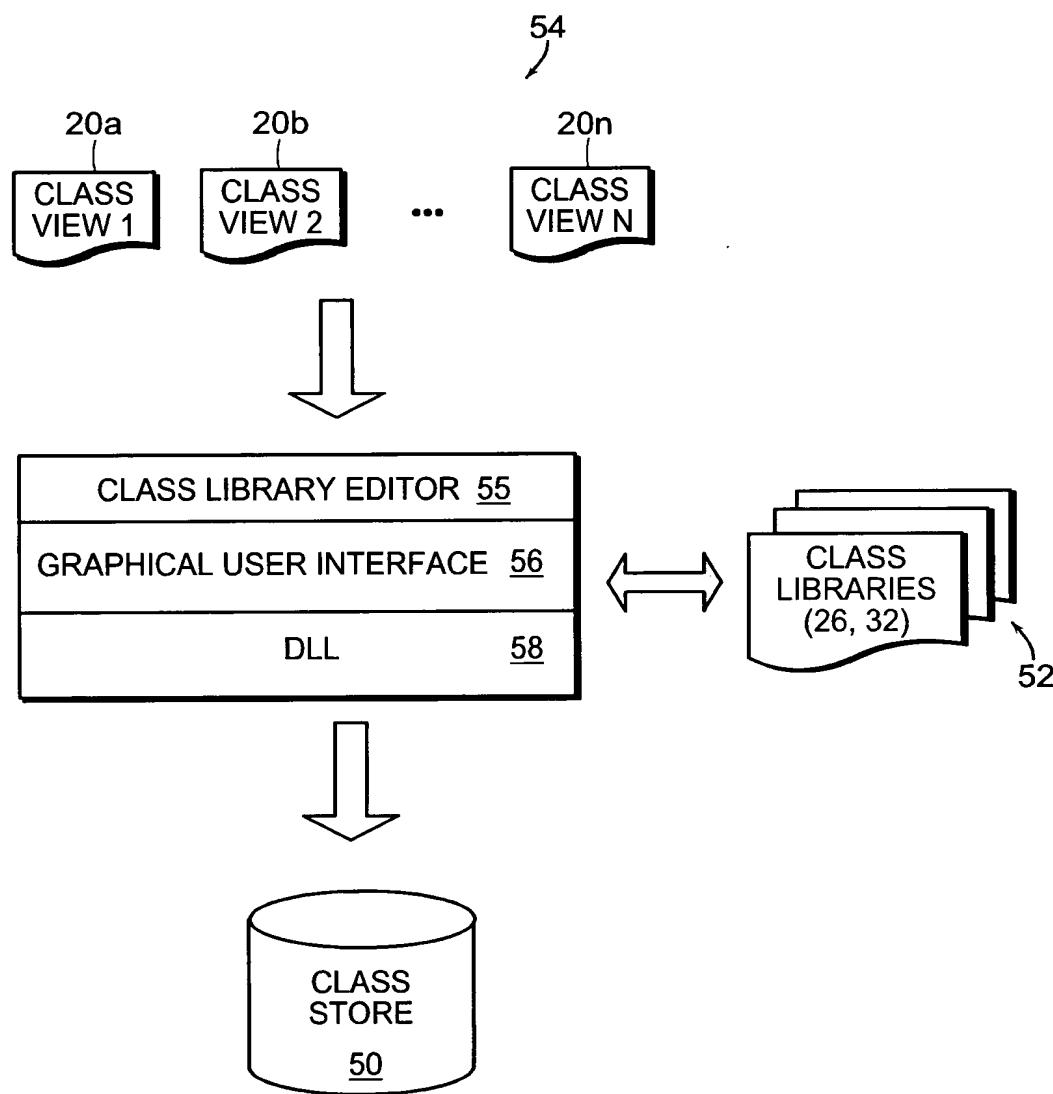


FIG. 7

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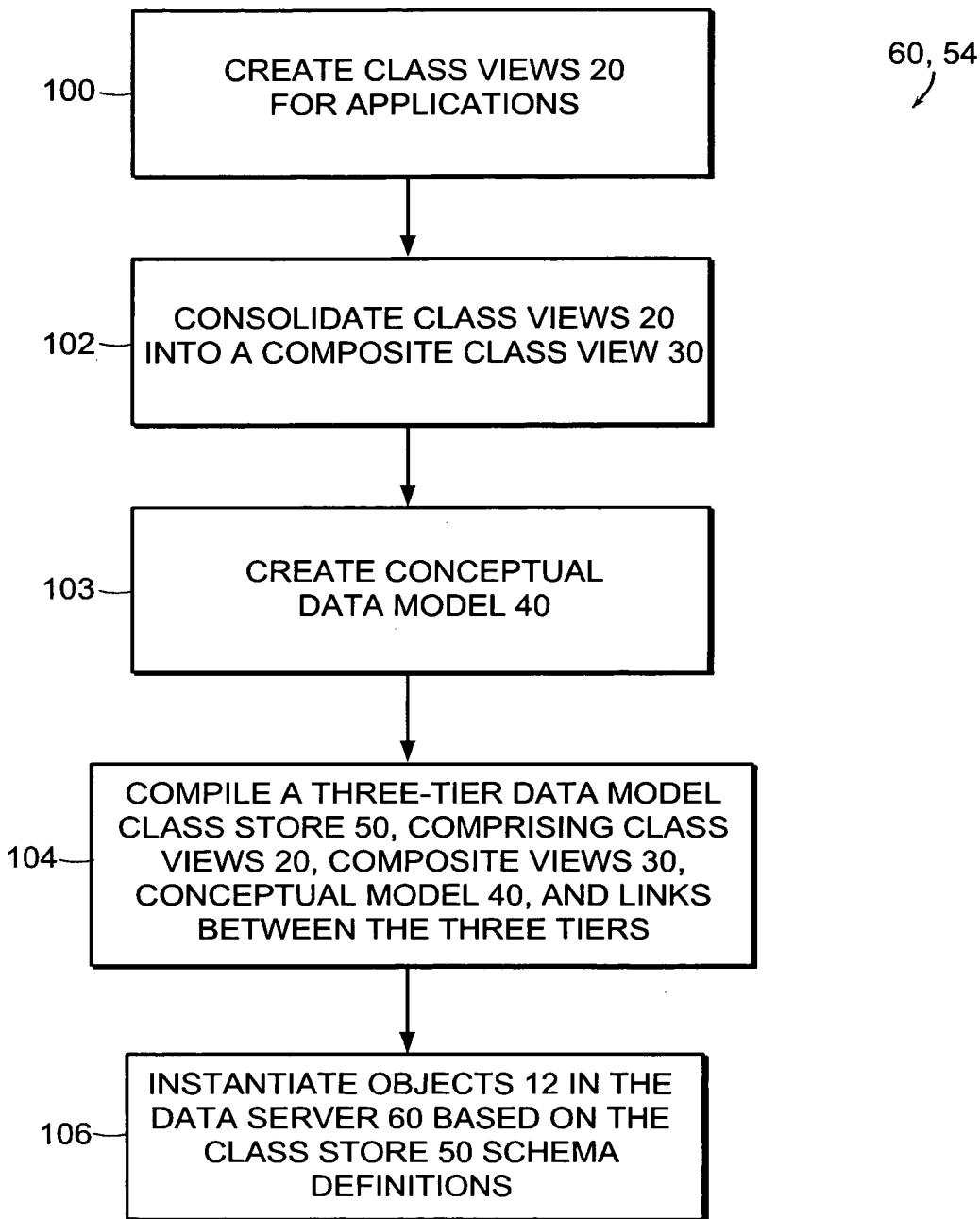


FIG. 8